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DELETED VERSION ONLY

A Preliminary Report of [DELETED] (Lacrosse)
ROP-92 5 July 1956
Issued as 5005-JFE
R25T

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LANL
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Prelim. Rpt. (Lacrosse)
ROP-92 7/5/56

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Lacrosse

Project 18.1, pages 105 thru 130 issued as a separate report (JO-229)

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OPERATION REDWING

A PRELIMINARY REPORT

OF

DELETED (LACROSSE)

Submitted by Task Group 7.1

5005JFE

5 July 1956

[redacted]

[redacted]

CONTENTS

[redacted]

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PAGE NO.

[redacted]

INTRODUCTION

This is a preliminary report, and therefore, does not give either complete or final results of the work of the various projects. No information on the construction of the device is included, in order that the classification may be kept to Secret Restricted Data.

The DELETED device was detonated on the north end of Runit Island, Eniwetok Atoll, at 0625:29.8, May 5, 1956, local time, as a ground shot. DELETED was designed as an externally initiated, DELETED primary,

DELETED

Therefore, the diagnostic experiments included measurements on fireball yield, radiochemical yield, external neutron threshold detectors, alpha transit time, performance of the ENS units, etc. Because of its expected yield, the device was also used as an energy source DELETED

DELETED

to determine nuclear vulnerability of stock pile weapons, and a variety of weapon effects tests.

This report gives results of the work of Task Units 1, 3, and 4. The work of other Task Units was either in support of the units mentioned, or concerned with the detonation of the device, and will be described in other reports.

The yield was about 39 KT, approximately as predicted,

DELETED

The and optical brightness experiments worked well, as did the various effects measurements.

[redacted]

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PART I

GENERAL INFORMATION

Observed Weather at Shot Time

Runit Island - Scientific Stations and Zero Point

Pre- and Post-Shot Photos

RadSafe Surveys at H + 8, D + 1, and D + 2

[redacted]

[redacted]

ENIWETOK OBSERVED WEATHER FOR 5 MAY 1956
LACROSSE SHOT TIME 0625M

Sea Level Pressure	1008.5 mb
Temperature	81°F
Dew Point	77°F
Relative Humidity	84%
Surface Wind	080°, 16 kts
Visibility	More than 10 miles

CLOUDS

1/10 cumulus, bases 1,500 feet, tops 4,000 feet; 1/10 altostratus, bases 18,000 feet, tops 19,000 feet; 5/10 cirrostratus, bases 43,000 feet, tops 44,000 feet. (Cloud bases and tops reported by aircraft)

There were no showers or other precipitation within 50 miles of Eniwetok.

STATE OF SEA

Eniwetok Lagoon:

Average of highest 1/3 of waves 1.5 feet on east side of lagoon increasing to 2.7 feet on west side of lagoon.

Open Sea:

Average of highest 1/3 of waves 4.5 to 6 feet, direction 080°.

ENIWETOK SOUNDING

Pressure Millibars	Height Feet	Temperature °C	Dew Point °C
1008	Sfc	27.2	23.8
1000	250	26.4	23.4
910		20.2	18.8
850	4,890	18.1	09.2
811		17.3	-02.5
700	10,270	09.5	-12.5
662		06.2	-15.8

10

[redacted]

[redacted]

Pressure Millibars	Height Feet	Temperature °C	Dew Point °C
611		02.2	-01.8
600	14,400	01.8	-09.8
500	19,140	-09.2	-12.2
445		-13.2	-29.2
400	24,720	-17.5	M
345		-26.2	-39.8
314		-30.8	-36.8
300	31,580	-33.2	-39.2
270		-38.5	-44.2
200	40,530	-55.0	M
150	46,360	-69.8	M
104		-80.0	M
100	53,960	-79.2	M
078		-76.0	M
066		-70.0	M
059		-71.0	M
050	67,390	-64.6	M
014		-47.0	

ENIWETOK WINDS ALOFT

Height Feet	Direction Degrees	Speed Knots	Height Feet	Direction Degrees	Speed Knots
Surface	030	15	25,000	260	24
1,000	100	24	30,000	240	37
2,000	110	24	35,000	260	52
3,000	110	24	40,000	260	60
4,000	110	25	45,000	240	59
5,000	110	29	50,000	240	61
6,000	100	30	55,000	280	39
7,000	100	28	60,000	130	8
8,000	090	23	65,000	130	13
9,000	090	20	70,000	030	10
10,000	100	20	75,000	110	28
12,000	100	11	80,000	090	42
14,000	110	5	85,000	100	56
16,000	150	4	90,000	100	63
18,000	230	4	94,000	100	57
20,000	240	13			

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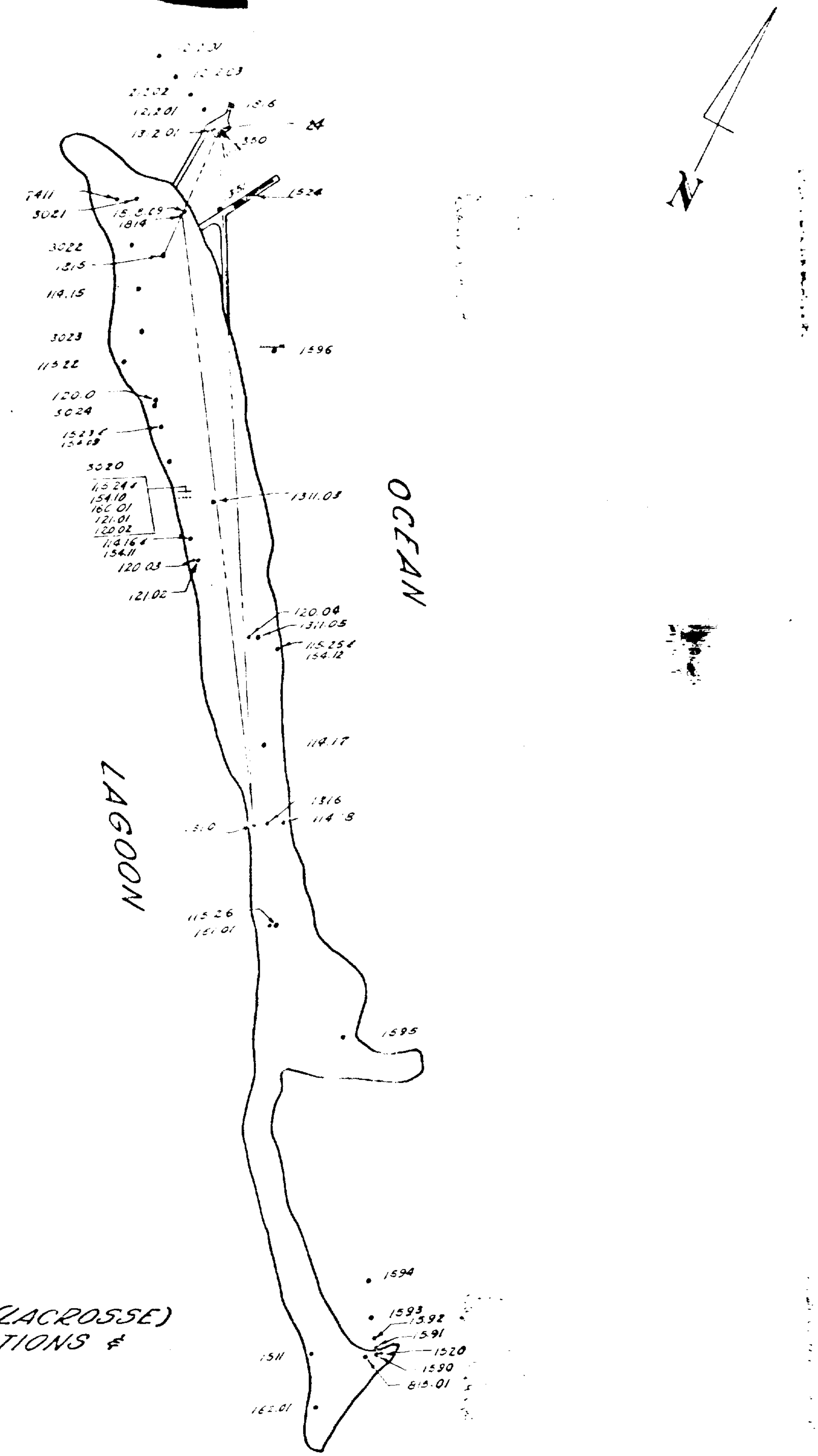

RUNIT ISLAND (LACROSSE)
SCIENTIFIC STATIONS &
ZERO POINT

FIG. 0-1

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READINGS IN MR/HR AT
INDICATED ALTITUDE
5 MAY, 1956
H+8

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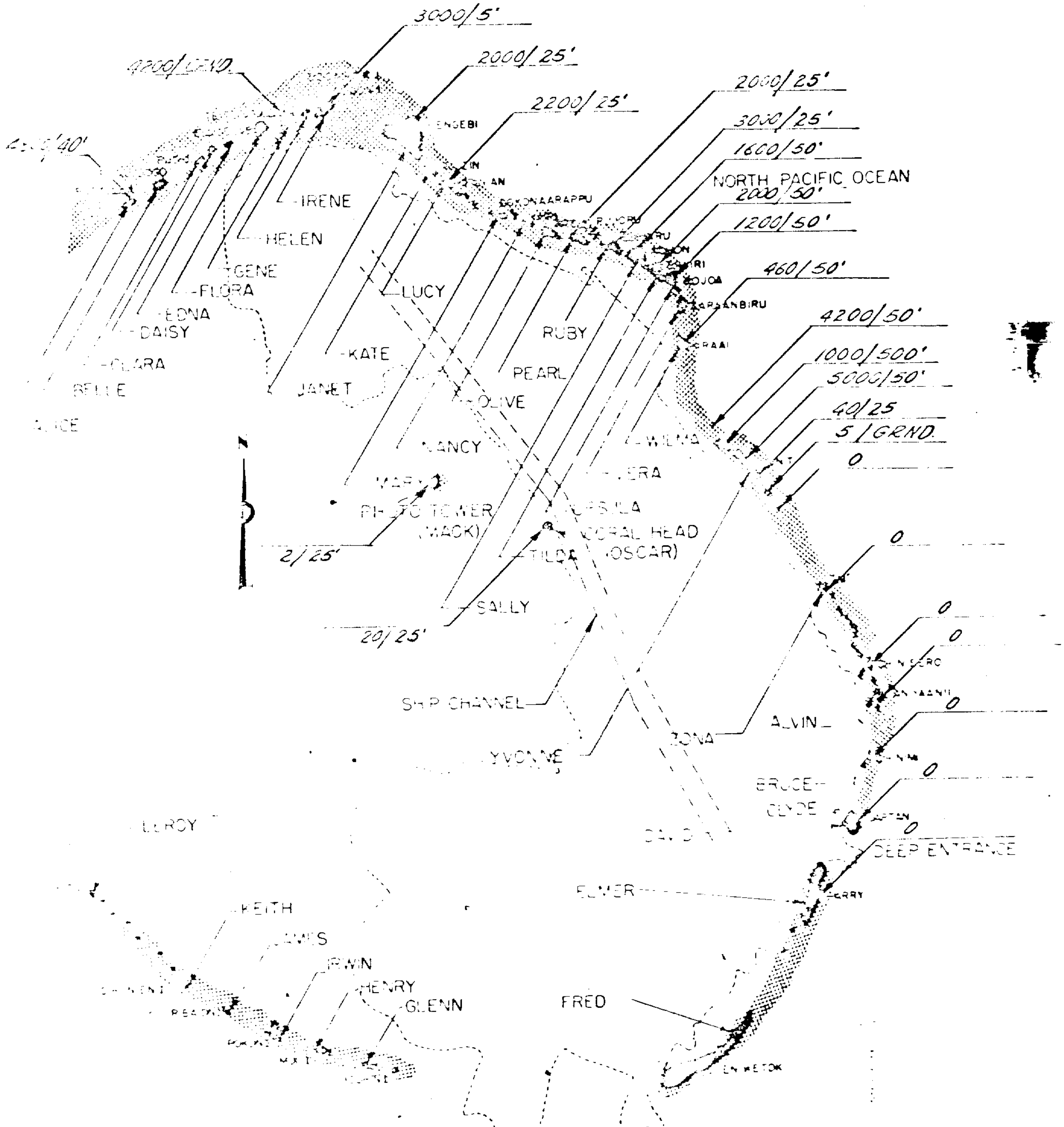

FIG. O-4

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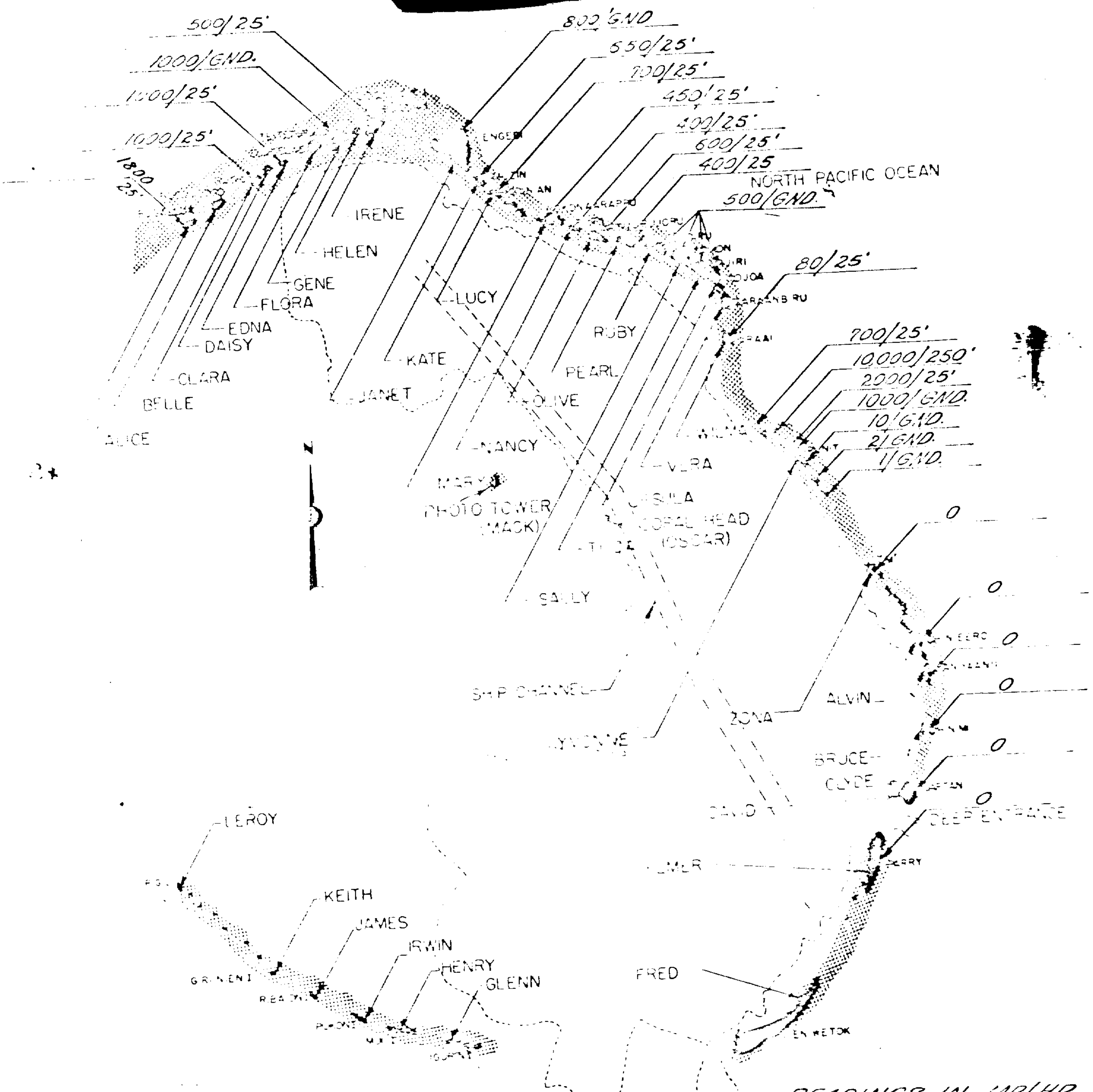

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READINGS IN MR/HR AT INDICATED ALTITUDES AS OF 1800, 6 MAY, 1956 (D+1)

FIG. 0-5

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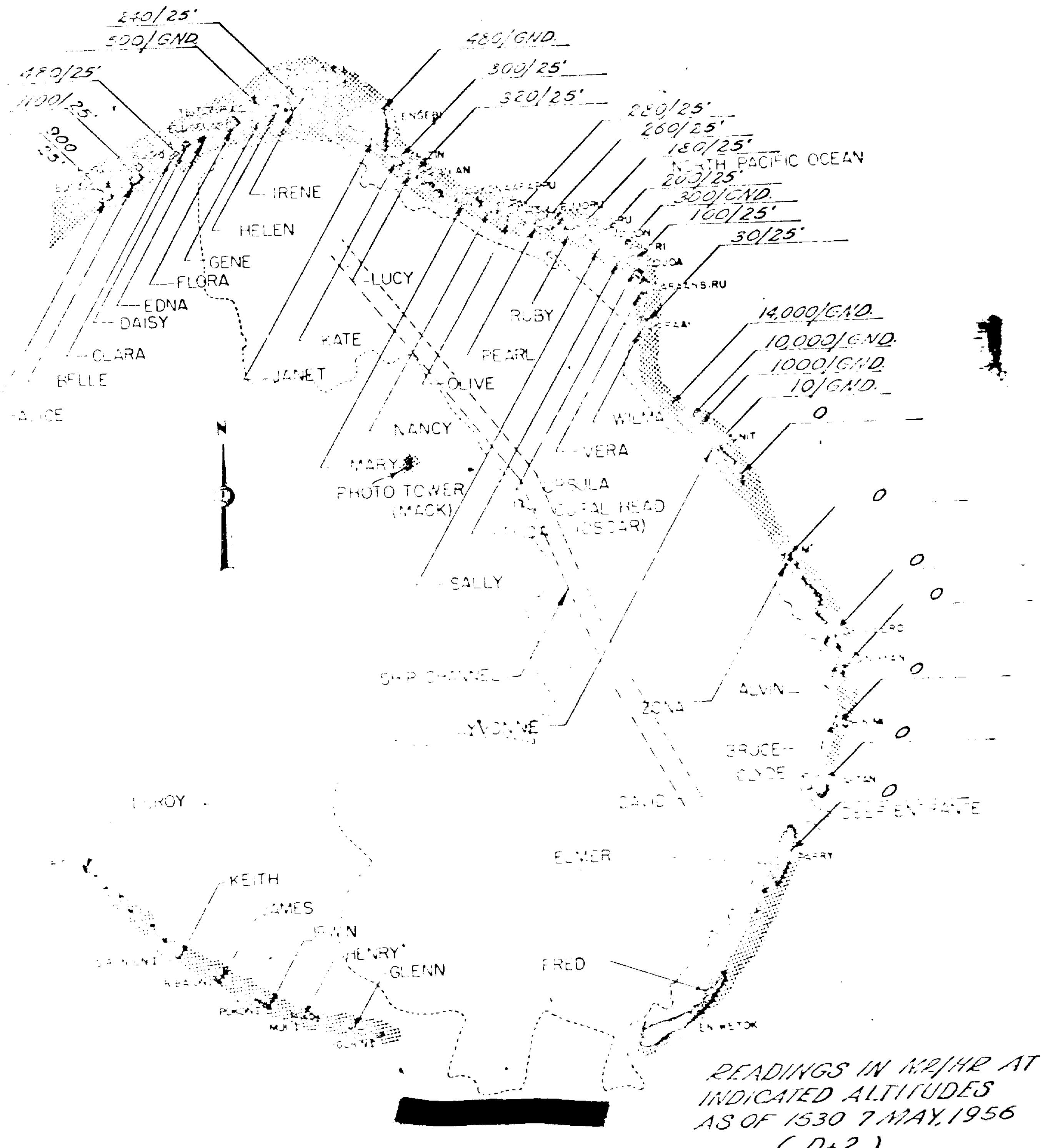

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FIG. 0-6

[redacted]

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PART II

TASK UNIT 3

DOD PROGRAMS

K.D. Coleman
Col. K.D. Coleman
CTU-3

Program 1 - Blast and Shock Measurements	Maj. H.T. Bingham
Program 4 - Biomedical Effects	Lt Col C. W. Bankes
Program 5 - Aircraft Structures	CDR A.R. Dahl
Program 6 - Test of Service Equipment and Materials	Lt Col C. W. Bankes
Program 8 - Thermal Radiation and Effects	CDR A.H. Higgs Maj. W.C. Linton
Program 9 - General Support	Lt Col J.G. James

[redacted]

[redacted]

LACROSSE

Project 1.1 - Basic Blast Measurements - J.J. Meszaros

OBJECTIVES

The primary objective of Project 1.1 in the LACROSSE participation was to measure air blast pressure and dynamic pressure at various distances along a blast line. From the pressure time records it was to be determined whether a precursor was formed from this size device detonated on the surface.

A secondary objective was to furnish Project 1.5 with dynamic pressure at the various locations of the jeep stations.

INSTRUMENTATION

The BRL self-recording pressure-time and "q" gages were used to record the air blast and dynamic pressure. The air blast gages are installed at surface level and the "q" gages are mounted at a height of 3 feet from the surface.

RESULTS

There were 15 pressure-time gages installed. Two of the 15 initiated prematurely giving a peak pressure only.

Fine sand tended to clog the pressure inlet hole and to prevent this a piece of carbon paper was taped over the hole. The paper burned off at stations out to a distance of 3350 feet. Beyond this distance the record shows a slow rise in pressure indicating the pressure inlet hole was clogged with sand or paper.

The results of the shot are presented in TABLE 1.1-1

[redacted]

[redacted]

TABLE 1.1-1

Station	Distance	Peak Pressure	Duration	Arrival Time
114.15	1180	121.8 138.0	.340	---
115.22	1590	55.9	Peak	---
115.23	1950	36.2	.531	.316
115.24	2500	19.8	.679	.650
114.16	2770	15.6	.719	1.007
115.25	3350	10.4	.872	1.301
115.31	3900	3.7*	---	1.504
114.18	4378	3.9*	.949	2.007
115.26	5200	3.1*	1.043	3.11[illegible]
115.26	5200	4.6	Peak	---

Station	Distance		Peak Pressure	Peak Dynamic
115.22	1590	t	150.0 *	94.0 *
		s	56.0	
115.23	1950	t	52.0	18.0
		s	34.0	
115.24	2500	t	27.2	7.2
		s	---	
115.25	3350	t	13.0	2.1
		s	10.9	
115.31	3900	t	9.3	1.1
		s	8.2	
115.26	5200	t	5.8	1.0
		s	4.8	

* Pressure values obtained are questionable.
t is total pressure, s is static pressure.

[redacted]

[redacted]

LACROSSE

Project 1.2 - SURFACE BLAST MEASUREMENTS OF STATIC AND DYNAMIC PRESSURES - A. D. Thornbrough

Carter D. Broyles

This experiment was designed to measure overpressure and dynamic pressure vs time from a surface burst of a medium yield (40 KT) nuclear explosion. Overpressures were measured with gages in ground baffles and pitot-static tubes. Dynamic pressures were measured with the pitot-static tube mounted 3 feet above the ground surface.

The overpressures and dynamic pressures are in general agreement with previous measurements of a 1 KT and of megaton bursts, being consistent with $W^{1/3}$ scaling and a reflection factor of 1.6 using a free-air pressure distance curve. However, a precursor of limited extent existed in the high pressure region (120-50 psi). It is expected that for more favorable conditions, that is, a low mass weapon and dry ground, the precursor would be more extensive.

The detailed results are given in the tables and graphs.

[redacted]

TABLE 1.2-1 OVERPRESSURE RESULTS

STATION	GROUND RANGE (ft)	GAGE	ARRIVAL TIME (sec)	PEAK POSITIVE PRESSURE (psi)	PEAK NEGATIVE PRESSURE (psi)	POSITIVE PRESSURE DURATION (sec)	NEGATIVE PRESSURE DURATION (sec)	POSITIVE PRESSURE IMPULSE (psi-sec)	NEGATIVE PRESSURE IMPULSE (psi-sec)
3021	690	1GBL	0.050	425	Record bad after 0.058 sec				
3021	690	1GBR	0.050	375	Record bad after 0.054 sec				
3021	690	1GBR-RF	0.050	320	Record bad after 0.090 sec				
3022	920	2GBL	0.104	160	e	0.48	e	8.4	e
3022	920	2GBR	0.102	135[a]	Record bad after 0.113 sec				
3023	1368	3P3	0.244	69[b]	4.3	0.40	4.5	4.5	10.8
3023	1400	3GBL	0.248	55[c]	3.7	0.40	4.3	5.7	5.7
3023	1400	3GBR	0.264	56[d]	2.5	0.4	3.5	5.2	5.9
120.01	1793	001P3	0.447	34	4.0	0.5	4.4	4.7	7.5
3024	1825	4GBL	0.462	34	5.5	0.5	4.5	3.5	12.5
3024	1825	4GBR	0.464	35	3.0	0.53	4.4	5.2	6.9
120.02	2500	002P3	0.841	16.9	2.1	0.62	4.3	3.0	2.8
121.01	2500	101GB	0.842	18.4	1.8	0.80	3.9	3.8	3.4
120.03	2900	003P3	1.096	12.8	1.7	0.84	4.0	3.4	2.5
121.02	2900	102GB	1.097	13.0	1.8	0.79	4.4	3.4	3.6
120.04	3250	004P3	1.330	10.9	1.3	0.87	4.6	3.0	4.6

a. Peak pressure at 0.110 sec, initial rise 100 psi.
b. Peak pressure at 0.268 sec, precursor pressure 14.9 psi [redacted]
c. Peak pressure at 0.292 sec, precursor pressure 23 psi.
d. Peak pressure at 0.286 sec.
e. Not Readable.

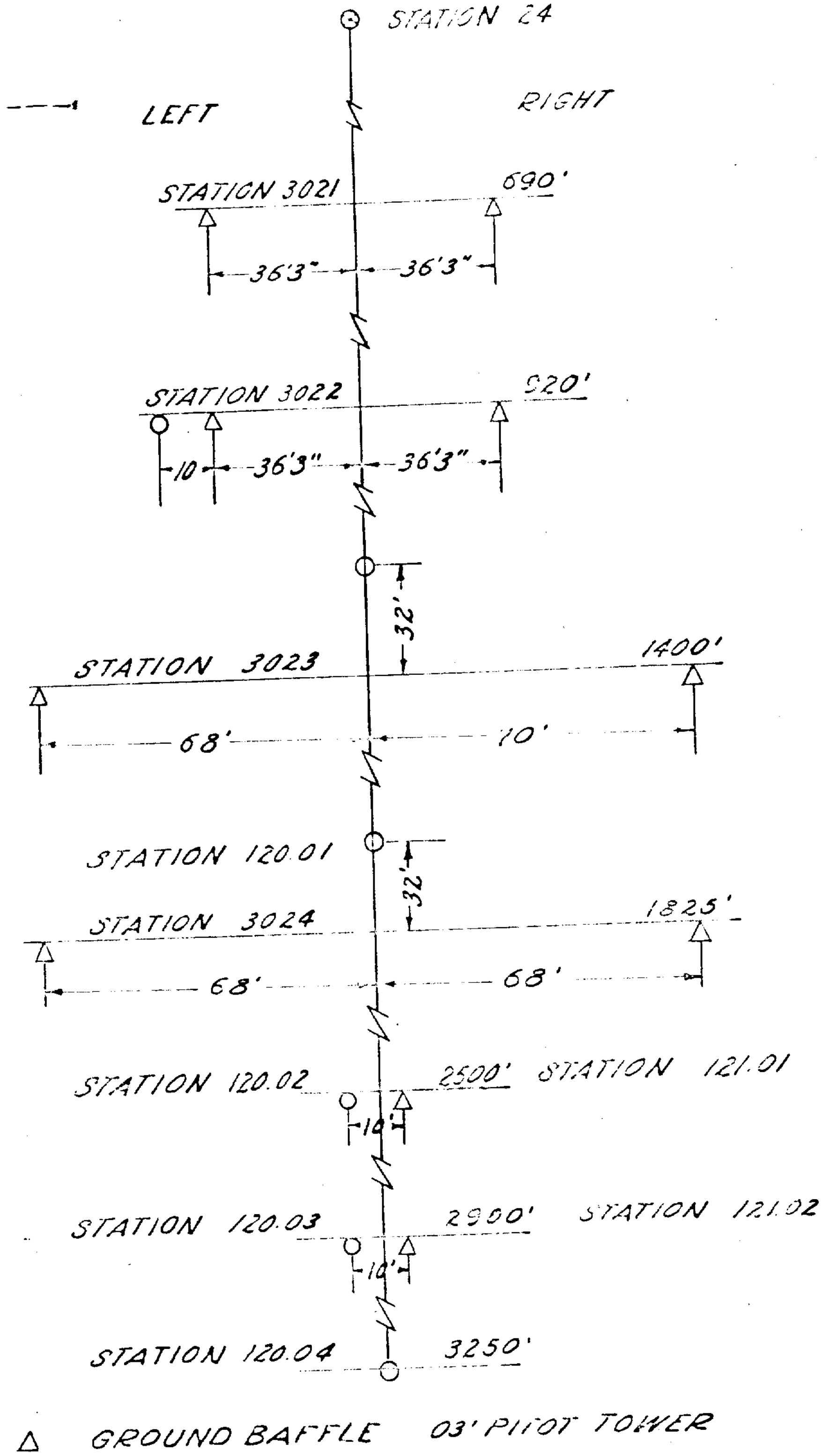
[redacted]

TABLE 1.2-2 DYNAMIC PRESSURE RESULTS

STATION	GROUND RANGE (ft)	GAGE	ARRIVAL TIME (sec)	PEAK DYNAMIC PRESSURE (psi)	DYNAMIC PRESSURE DURATION (sec)	DYNAMIC PRESSURE IMPULSE (psi-sec)
3022	920	2q3	0.104	265	0.12	7.0
3023	1368	3q3	0.244	180[a]	0.78	7.3
120.01	1795	001q3	0.446	23	0.23	2.2
121.02	2500	002q3	0.840	6.9	0.67	0.93
120.03	2900	003q3	1.096	4.1	0.9	0.86

a. Peak pressure at 0.110 sec, initial rise 100 psi.

[redacted]



DETAIL OF GAGE STATIONS
STATIONS NOT ON SAME RADIAL LINE

FIG. 1.2-1

[redacted]

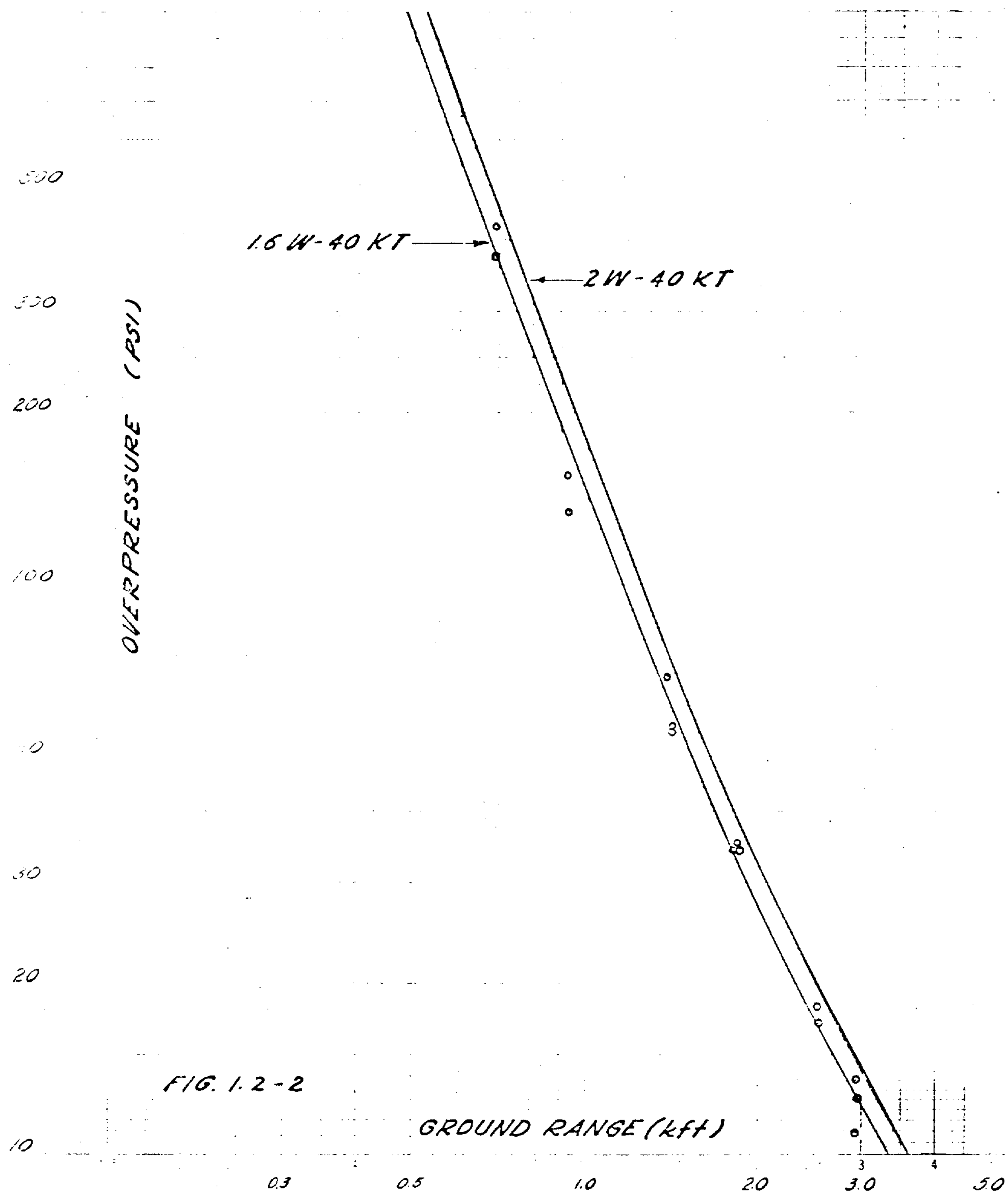
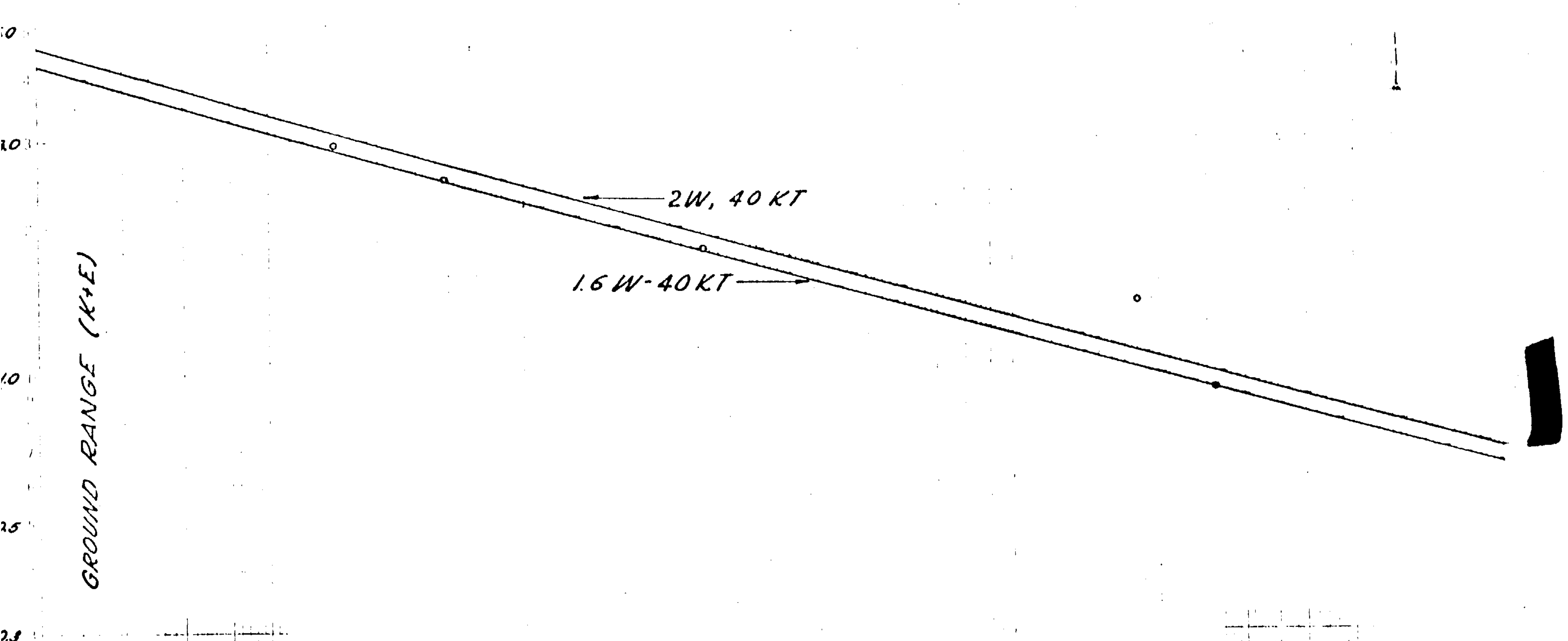


FIG. 1.2-2

OVERPRESSURE vs. GROUND RANGE

[redacted]



DYNAMIC PRESSURE
VS.
GROUND RANGE

FIG. 1.2-3

DYNAMIC PRESSURE ([redacted]

[redacted]

Project 1.3 - SHOCK PHOTOGRAPHY - J. Petes

OBJECTIVES

The objectives for this shot were as follows:

1. To study the mechanical effects of a water surface on shock propagation.

2. To study the thermal effects, if any, resulting from the heating of air near the ground surface on shock transmission.

3. To determine peak shock overpressure as a function of distance both at the surface (water) and above ground zero.

INSTRUMENTATION

The instrumentation for this shot included both smoke rocket photography and direct shock photography.

The rockets were fired from a station on the reef, 3,000 feet NW of ground zero. Cameras were located on the south end of YVONNE and at the Mack tower.

RESULTS

The rocket instrumentation was successful and three films of good quality were obtained from the photo station on the south end of YVONNE. These films will be usable for the determination of peak shock overpressure (objective 3) and for a study of the mechanical effects of a water surface on shock propagation (objective 1).

As the result of a power failure on the Mack tower, no films were obtained. Consequently, a study of thermal effects on this shot is impossible (objective 2).

[redacted]

[redacted]

LACROSSE

Project 1.5 - Drag Characteristics of various shapes - Vehicle Damage Effects - J.J. Meszaros

OBJECTIVE

To compare the damage of this detonation to Shot 2 of Operation TEAPOT. It seems that the vehicle damage from Shot 2 DELETED was greater than expected. The exposure of vehicles to Shot LACROSSE is an effort to check damage prediction for this size weapon.

TECHNIQUES

Ten vehicles, truck, 1/4 ton 4x4 utility, WW II Model MB were arranged in pairs at five stations from GZ. The stations were 2500, 2770, 3350, 3900, and 4378 feet from GZ. One vehicle at each station was oriented with the front facing GZ (face-on) while the side of the other vehicle was towards GZ (side-on). Steel stakes were driven in the ground at each vehicle station to facilitate displacement measurements.

RESULTS

Evaluation of the damage revealed moderate damage to the side-on vehicles at the 2500 feet and 2770 feet station. The damage to all other vehicles was considered light damage. Six of the latter vehicles were considered immediately combat useable requiring no maintenance other than filling with fuel, water or battery acid while the other two vehicles sustained a broken oil line and bent steering shaft and column. The face-on vehicles remained upright. Five of the side-on vehicles were overturned; four upside down and one on its left side.

Displacement for the face-on vehicles ranged from 33' at the forward station to one foot at the most distant station. The side-on vehicles displacement ranged from 123 feet to 9 feet respectively.

[redacted]

[redacted]

No serious thermal effects were noted other than scorched paint and seats. Static pressure effects observed included partially collapsed fuel tanks and tool compartments at the two closest stations.

CONCLUSIONS

In general the damage was less than expected when compared to probability damage as obtained from the formulae and curves of TM23-200. One contributing factor to the lighter damage was the soft sandy soil at the vehicle stations. Complete explanation for the reduced damage is not fully apparent and conclusions from this shot will have to await thorough analysis of pressure records.

[redacted]

[redacted]

LACROSSE

Project 1.6 - DRAG LOADING ON MODEL TARGETS - J. Petes

The U. S. Naval Ordnance Laboratory participated in Operation REDWING on Shot LACROSSE with a project designed to study drag force loading on model targets. Two and three component force gages were used with test models of cylindrical, parallelepiped, cubical, and spherical shapes. Shot LACROSSE, approximately 40 KT yield device, was detonated at the ground surface and produced at the distances of interest, 2,500 feet and 5,200 feet from ground zero, essentially clean, Mach shocks with negligible precursor, thermal, or dust disturbances. At these distances, side-on over-pressures and dynamic pressures of 18.1 psi and 6.1 psi, and 4.5 psi and 0.47 psi respectively, were measured by this project.

All instrumentation operated satisfactorily and complete drag force-time histories were obtained from all gages. Good agreement was obtained in wave shapes and amplitudes between similar gages at a station, thus establishing a high confidence level in the reproducibility of the gages and reliability of the data. The stingless configurations of cubes mounted on ground planes, and cylinders and parallelepipeds gave highly reproducible results and reasonable drag coefficient values. The C_D's for these models did not vary significantly between the high q and low q regions; C_D values obtained were 1.0 for the 4" cubes, 0.87 for the 6" diameter cylinders, and 1.38 for the 6" x 6" cross-section parallelepipeds.

The spherical models mounted on stings did not produce data readily interpretable. Drag coefficients at the low q region were higher by a factor of two than the C_D values at the higher q region. Results similar to this 30

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[redacted]

were obtained in early laboratory experimentation for Operation TEAPOT. The raw data of MET, Operation TEAPOT, and LACROSSE are not apparently in agreement; only one out of four comparable gage and shock conditions appears to produce data that is in agreement.

The full evaluation of LACROSSE results await the completion of a laboratory drag study, further study of the LACROSSE data obtained by this project and by other projects, and full evaluation of data. This will be accomplished in the final report.

[redacted]

[redacted]

Project 1.8 - CRATER MEASUREMENTS - Captain F. E. Deeds

OBJECTIVES

The objective of this project was to measure the physical characteristics of the crater produced by detonation of an atomic weapon at ground surface. A further objective was to correlate data obtained with previous surface bursts at the Pacific Proving Grounds (PPG) and with the JANGLE surface shot at the Nevada Test Site. The crater is an important effect of a nuclear detonation when used on hard targets or underground emplacements. A thorough understanding of this phenomena is necessary to predict proper usage to achieve the desired results.

INSTRUMENTATION OR TECHNIQUES

Preshot Survey: Rays extending from ground zero and 60 degrees apart were surveyed to a distance greater than the expected crater radius (Fig. 1.8.1). The elevations found varied from 0.3 to 2.2 feet above the datum plane (6 inches below mean-low-water springs) for distances out to 450 feet from ground zero. Uncontrolled stereoptic aerial photographs were taken of the shot area.

Postshot Survey: Aerial photographs were taken at H + 2 to measure crater diameter with stereoptic equipment. Depth of the crater, above water surface, can also be measured by the same means. A USAF RB-50 E aircraft equipped with a USAF Aerial mapping Camera, T-11, having a 6-inch-focal-length lens was used to make the mapping runs. The camera was gyroscopic stabilized mounted and the intervalometer was set for a forward overlap of 57 to 62 percent. The aerographic film was developed at the PPG to insure proper coverage of the target and sent to the Engineer Research and

[redacted]

Development Laboratories for analysis. The aircraft was equipped with radio altimeter, FCR 718, with an accuracy of ± 25 feet between 200 and 60,000 feet altitude over smooth terrain. Readings were taken from the radio altimeter at the time the plane came into the flight pattern for making the aerial photographs and any changes were noted. Passes were made at altitudes of 1,740, 1,700, and 1,750 feet.

Radiation has prevented making postshot depth survey; but this will be accomplished as soon as possible. Range poles will be placed at the end of the pre-surveyed Radii 2, 3, and 4 (Fig. 1.8-1), and transits will be set up at the end of Radii 1, 5, and 6. An LCM or DUKW will enter the crater and lead line soundings, five per radii, will be made and the point of the sounding will be triangulated by the transits.

RESULTS

Because residual radiation was high enough to prevent postshot survey, it was decided that a lead line sounding would be made from a helicopter at approximately ground zero. A Rad-Safe survey flown at an altitude of 10 feet was made at D + 11 (1300 hrs 16 May 56) giving the results as shown in Fig. 1.8-2. On D + 12 (17 May 56), a sounding was made from a helicopter which hovered over ground zero at approximately 25 feet. The sounding made, corrected to the datum plane (6 inches below mean low water spring), gave the depth of the crater to be 45.4 feet. The survey took approximately 15 minutes for positioning the helicopter and making the sounding; persons exposed received zero radiation.

The postshot aerial photographs were studied; the diameter from rim to rim of the lip was estimated to be 430 feet.

CONCLUSIONS

No conclusions can be drawn until the findings of the film analysis and the lead line soundings have been made.

[redacted]

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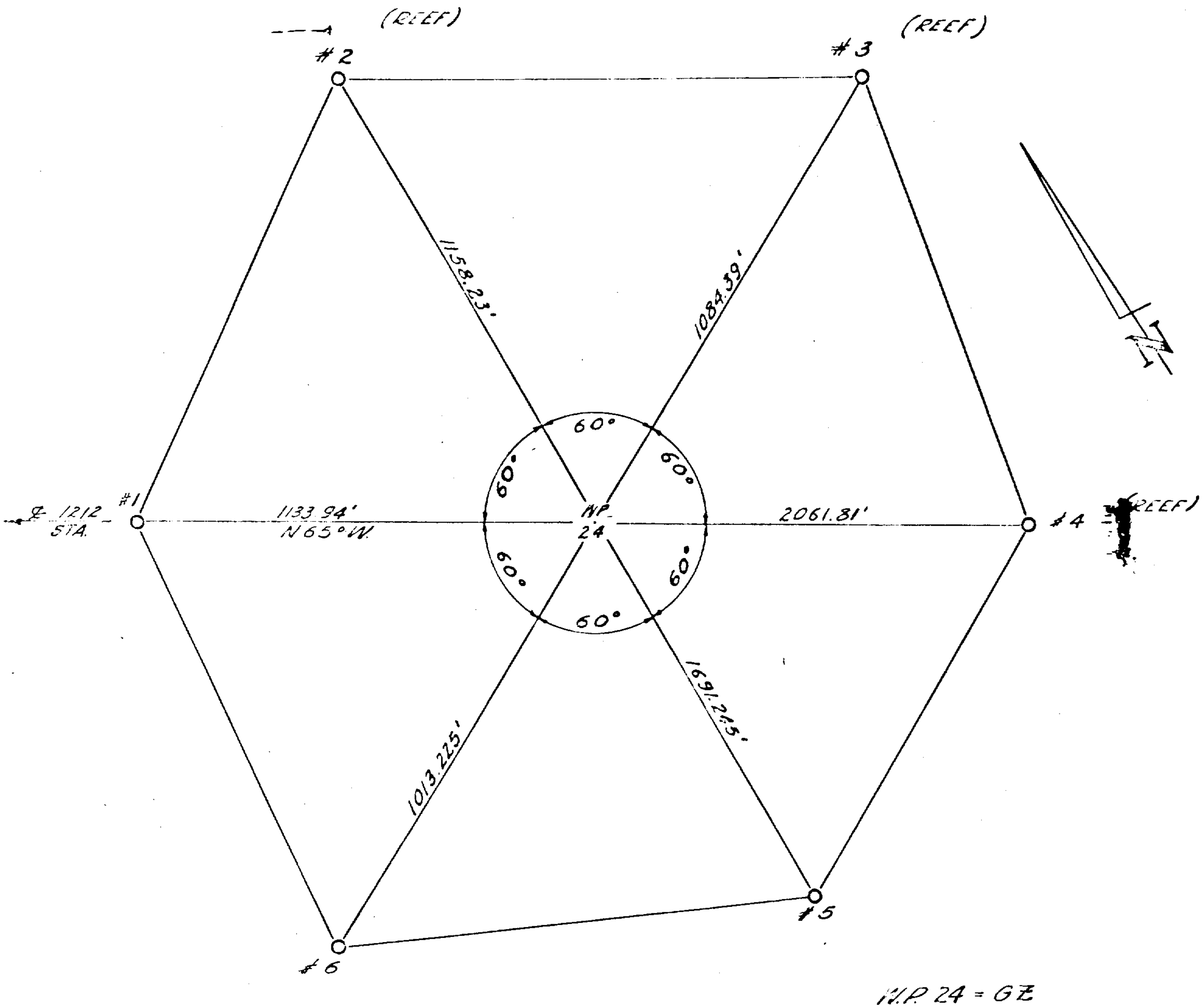

LACROSSE-LAYOUT OF PRE SHOT SURVEY

FIG. 1.8-1

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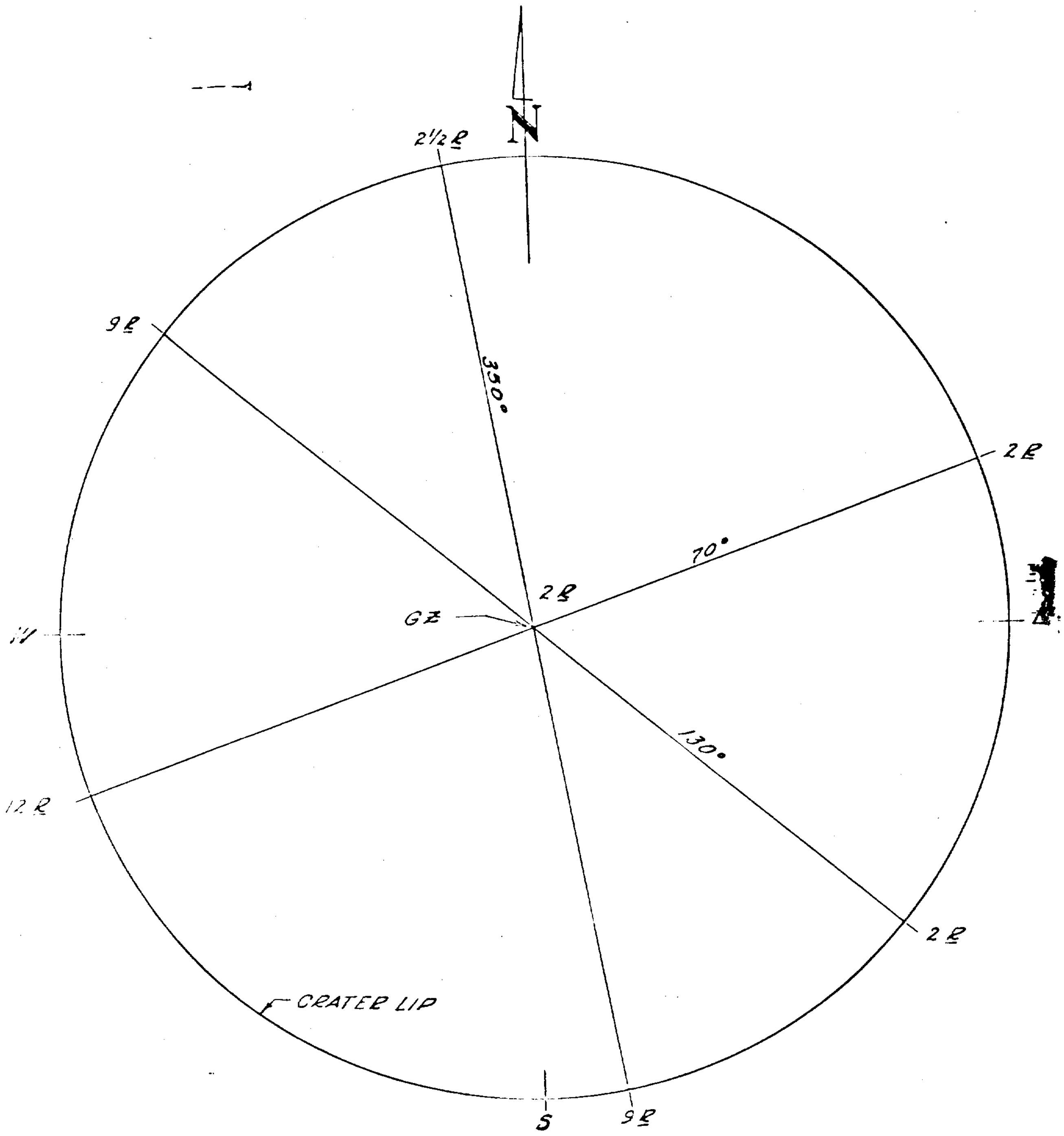

LACROSSE, RAD-SAFE CRATER SURVEY
1300 HR - 16 MAY 56

FIG. 18-2

35
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[redacted]

LACROSSE

Project 2.64 - FALLOUT LOCATION AND DELINEATION BY AERIAL SURVEY - R. Graveson

OBJECTIVES

To survey the gamma radiation from fallout contaminated lagoon islands, lagoon water area and ocean areas using an aircraft borne detector.

DESCRIPTION AND EXPERIMENTAL PROCEDURE

One P2V-5 aircraft was equipped with gamma radiation detectors to record the dose rate arriving through the thin aircraft skin from the surface below.

The aircraft starting approximately H + 3 was to fly over all islands in the Eniwetok Atoll at an altitude of 300 feet, then survey the lagoon area to the west of YVONNE. After survey of the atoll, the aircraft would continue search and survey over the open ocean to the north and east, perhaps to a distance of 75 miles. During the flight, the activity observed by the aircraft was to be recorded on a strip chart. This data would eventually be subject to analysis in an effort to establish ground surface radiation contours.

During the survey of land surfaces, some special attention and possibly repeated passes were contemplated for the LACROSSE crater.

RESULTS

A series of misunderstandings associated with the mechanics of filing flight plans and the purpose of the mission delayed the aircraft entry into the area of interest for a period of 4 hours. Further confusion resulted in prohibiting the aircraft from flight lower than 1,000 feet and ordering it away from the atoll land areas. Rain squalls over the lagoon area presented an immediate possibility of aircraft contamination. All circumstances combined to withdrawing the mission without any data.

[redacted]

LACROSSE

Project 2.65 - ANALYSIS OF FALLOUT AND OF BASE SURGE - M. Morgenthau

OBJECTIVES

The general objectives of project 2.65 participation in REDWING were to: (1) obtain fallout samples on land and to perform radiophysical and radiochemical measurements on the samples; (2) prepare dose rate contours of the atoll area from information gathered by this project, other projects, and Rad-Safe; and (3) evaluate the role of the base surge in transport of radioactive material.

Project 2.65 had only limited participation in LACROSSE. The main purpose for this participation was to obtain dose rate contours near the crater.

DESCRIPTION AND EXPERIMENTAL PROCEDURES

Stations at Eniwetok Atoll were equipped with a Gross Fallout Collector (GFC).

On D-day, D + 1, and D + 2, an aerial survey of residual radiation was made over the respective atolls by helicopter. The measurements were taken by means of a probe on a long cable suspended below the hovering helicopter. The position of the probe was determined by comparison with maps and aerial photographs.

STATION LOCATIONS

The instrumentation at the various stations is shown in Fig. 2.65-1.

RESULTS

Aerial Survey: Aerial survey readings taken on three successive days are plotted as a function of time in Fig. 2.65-2. The average slope of the field gamma-decay curves for the islands shown during the interval H + 18 to H + 50 hours is -1.3. The corrected dose rates and the corresponding H + 1 hour values

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[redacted]

[redacted]

are given in Table 2.65-1. The H + 1 hour values were determined using -1.3 as the gamma-decay exponent as determined from the curves of Fig. 2.65-2. The survey points on YVONNE and WILMA are shown in Fig. 2.65-3 along with the corresponding H + 1 hour readings. Fig. 2.65-4 shows the H + 1 hour average dose rates for the seven islands surveyed.

Decay Data: Gamma dose rate decay was determined by counting gross fallout samples with a Jordan Survey Meter mounted in a lead pig for constant geometry. A typical gamma-decay curve is shown in Fig. 2.65-5. A typical beta-decay curve is shown in Fig. 2.65-6.

Radiochemistry: Ground scoop samples were recovered from Sites WILMA and GENE. Another sample was retrieved from a depression in the canvas top of an abandoned truck at Site GENE. It was discovered that all the particles from the truck canvas were radioactive, while very few of the particles from the ground samples were radioactive. This observation, plus the opinion that it is improbable for particles other than fallout to be collected at the height of a truck cab, led to the belief that this sample is representative of the fallout in that area. All of these samples were size-graded into various size fractions, and radiochemical analyses for Np^{239} and Mo^{99} were performed on each fraction. From the analysis, the following conclusions were drawn:

1. Np^{239} fractionates with respect to Mo^{99} as a function of particle size. As shown in Table 2.65-2, the ratios of Np^{239} to Mo^{99} and the capture/fission ratios, which are proportional to them, appear to decrease as the particle size of the sample increases. Even the lowest value, 0.14, is almost twice the 0.036 value reported by LASL for a cloud sample.

2. The individual contributions of Np^{239} and Mo^{99}, in relative units, to the total beta activity of the samples generally increase with increasing particle size.

[redacted]

Microscopic observations of the fallout collected from the GENE truck canvas indicated at least two general types of particles. One type resembled natural coral, while the second was either partially or totally black. The black particles were ferromagnetic to varying degrees and gave positive qualitative tests for iron. The white particles were composed of both calcium carbonate and calcium hydroxide (or oxide). The hydroxide, or oxide, appeared to be uniformly distributed through the volumes of the particles. On the average, the black particles were individually about four times as radioactive as the white particles, but the former represented only 20 percent by number of the total particles in the size fractions larger than 50 microns. The radioactivity of both types of particles appeared to be uniformly distributed through the volumes of the particles.

The bulk density of the samples from the Total Fallout Collector at Site WILMA and from the GENE truck tarpaulin was 2.66 gm/cm^3. The bulk density of PARRY Island soil was found to be 2.70 - 2.75.

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TABLE 2.65-1

CORRECTED AERIAL SURVEY READINGS - LACROSSE
(FIELD GAMMA-DECAY FACTOR: -1.3)

ISLAND	SURVEY POINT	TIME AFTER SHOT (hr)	CORRECTED READING (mr/hr)	R/HR AT H + 1 HR.	AVG H + 1 HR DOSE RATE (r/hr)
YVONNE	1	7.3	170	2.2	
	2	9.25	130	2.3	
	3	9.3	1700	30.6	
	4	26.17	2500	175.0	
	5	50.25	2000	328.0	
	6	50.3	14000	2301.0	
	7	26.25	56000	3920.0	
	8	26.3	45000	3160.0	
	9	26.83	500000	35000.0	
	10	50.83	15000	2480.0	
	11	50.5	3800	627.0	
	12	50.58	760	125.0	
WILMA	1	7.5	700	9.7	
	2	26.1	240	17.4	
	3	50.7	75	12.4	
	Grd rdg at GFC Stat.	10.1	800	16.0	14.0
	Grd rdg on ocean side	54	90	16.0	
ZONA	1	7.25	150	2.0	2.0
TILDA	1	7.58	5000	69.0	
	2	26.0	1100	75.0	67.0
	3	50.58	350	58.0	
PEARL	1	7.7	6000	85.0	
	2	26.0	1200	83.0	83.0
	3	50.5	500	82.5	
JANET	1	7.75	7000	98.0	
	2	25.83	1400	95.0	94.0
	3	51.4	530	90.0	
DAISY	1	7.83	13000	192.0	
	2	25.65	2900	193.0	180.0
	3	50.28	900	156.0	

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[redacted]

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TABLE 2.65-2 LACROSSE CAPTURE/FISSION DATA

SAMPLE	PARTICLE SIZE FRACTION	Np^{239}/Mo^{99} (Dist. Rate) at H - HOUR	CAPTURES / FISSIONS
Piiraai (WILMA) Ground Sample	0-44	3.25	0.16
	44-74	3.09	0.16
	74-105	3.81	0.19
	105-149	3.20	0.16
	149-210	2.91	0.14
	210-420	2.78	0.14
Teiteiripucchi (GENE) Truck Canvas	0-44	5.65	0.28
	44-74	6.29	0.31
	74-105	4.03	0.20
	105-149	3.98	0.19
	149-210	3.05	0.15
	210-420	3.65	0.18
	420-840	3.72	0.18
	Total Solid	3.88	0.19
Teiteiripucchi (GENE) Ground Sample	0-5	5.23	0.26
	5-14	5.08	0.25
	10-22	4.62	0.22
	16-32	4.70	0.23
	26-40	5.10	0.25
	40-50	4.29	0.21
	44-74	3.52	0.17
	74-105	3.62	0.18
	105-149	3.29	0.16
	149-210	3.78	0.18
	210-420	2.97	0.14
Cloud Sample (Data obtained from J-11, LASL)			0.086

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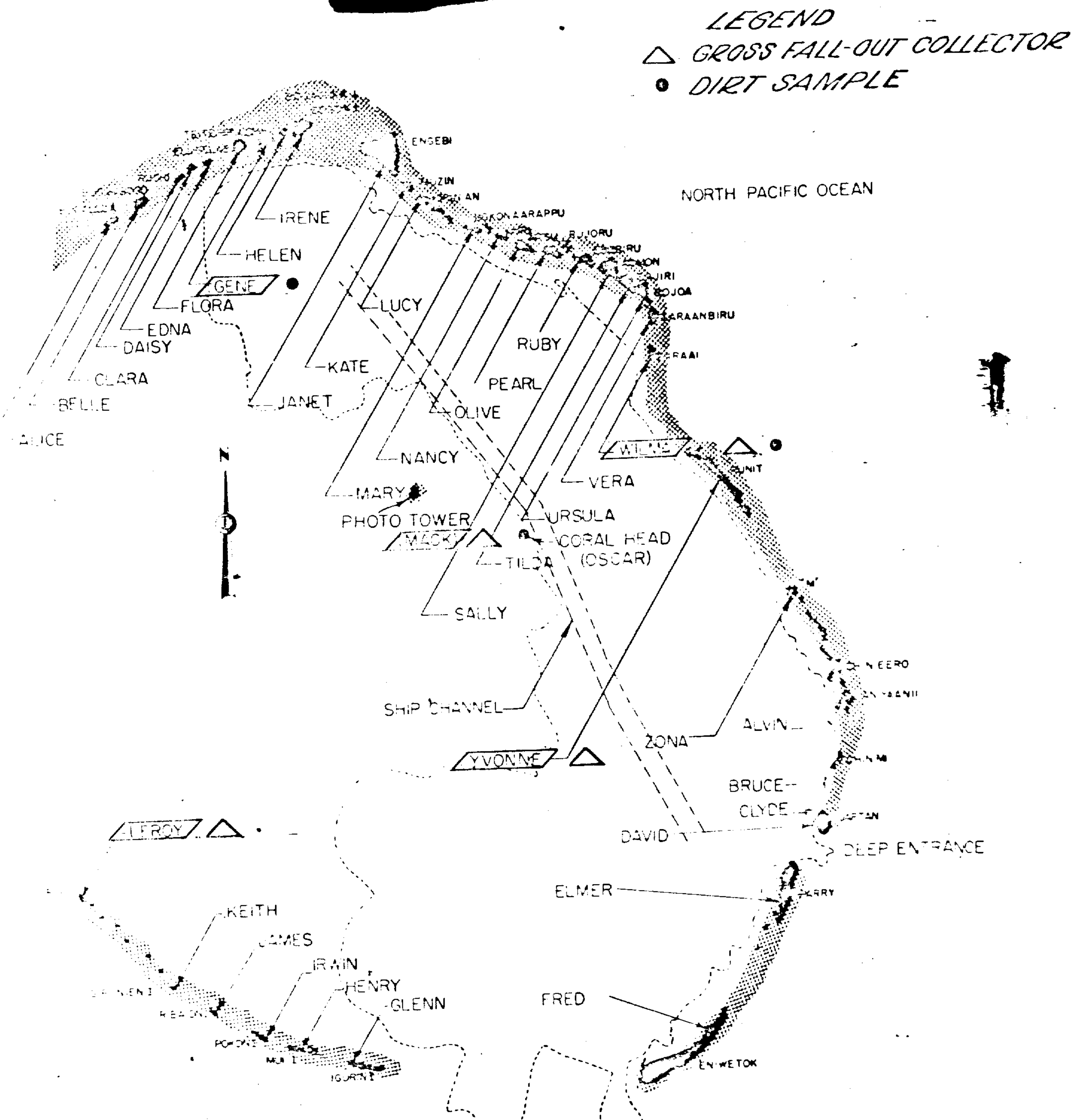
[redacted]

[redacted]

[redacted]



[redacted]

FIG. 2.65-1

[redacted]

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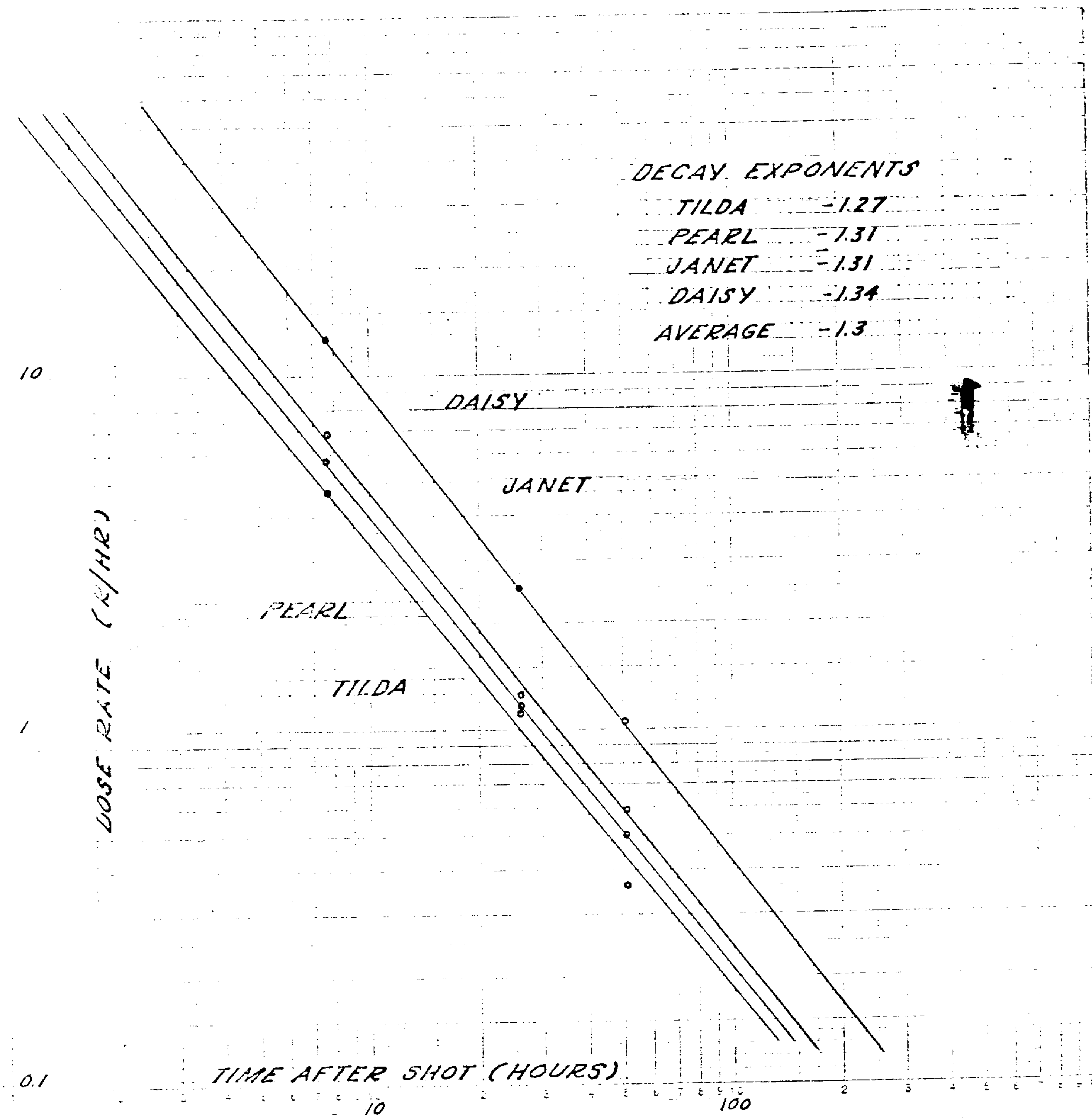
[redacted]



AERIAL SURVEY READINGS AT 3' LEVEL
TAKEN ON SUCCESSIVE DAYS
(CORRECTED READINGS)

FIG. 2.65-2

[redacted]

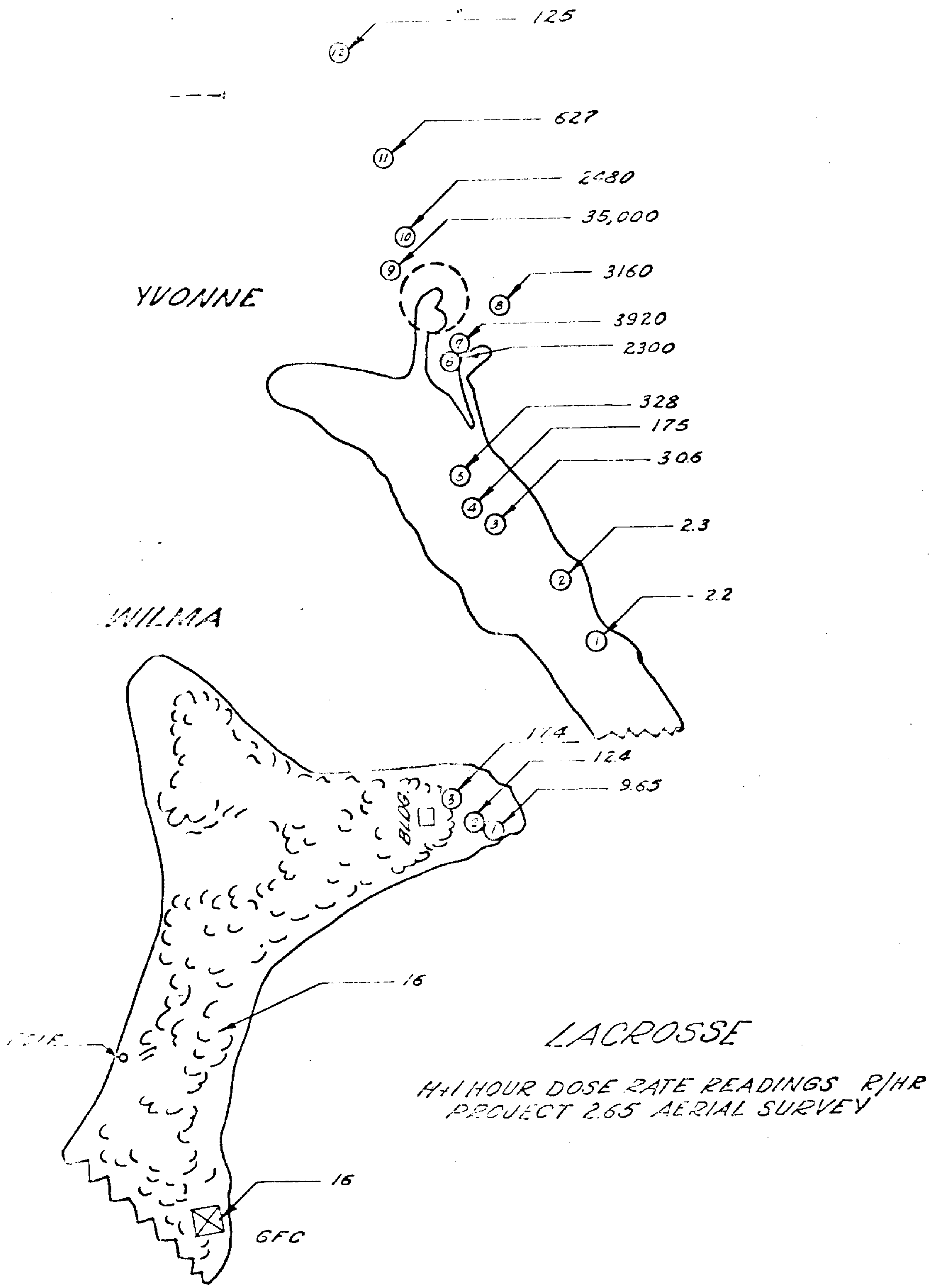
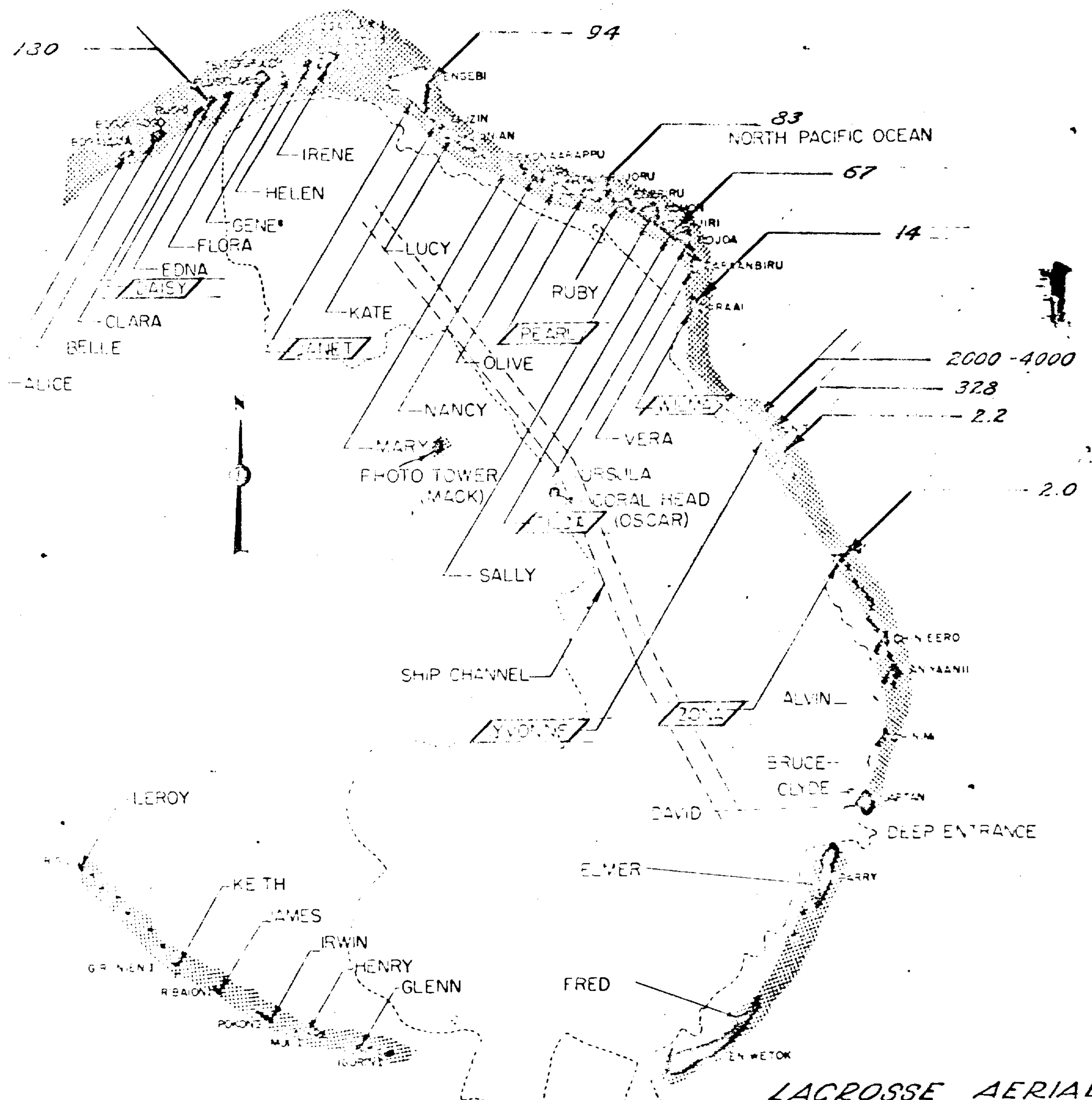


FIG. 2.65-3

[redacted]

[redacted]

[redacted]

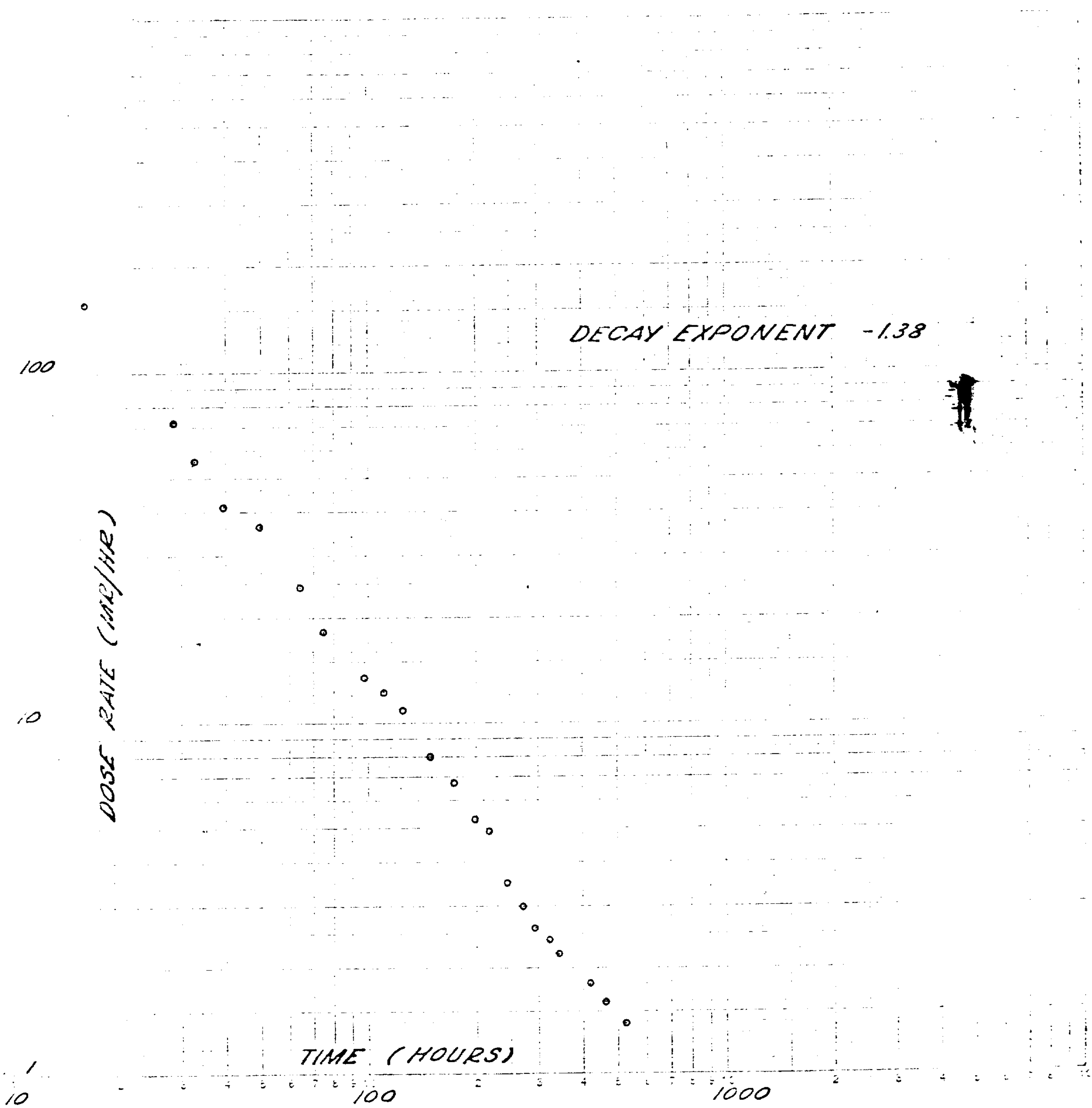


[redacted]

FIG. 2.65-4

LACROSSE AERIAL SURVEY CORRECTED TO H+1HR IN (R/HR)

[redacted]



TYPICAL LACROSSE γ DOSE RATE DECAY CURVE

FIG. 2.65-5

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[redacted]

[redacted]

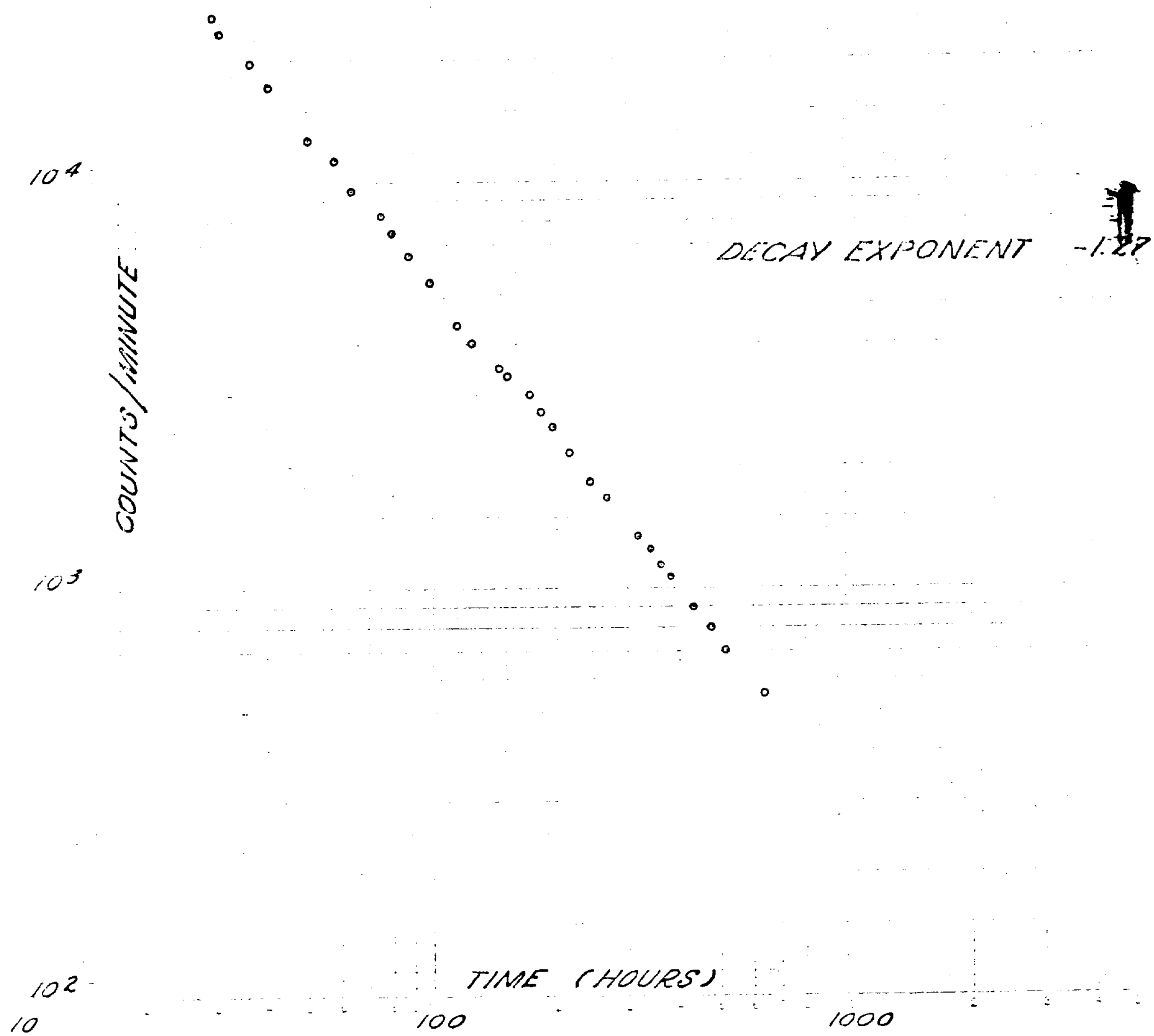

FIG. 2.65-6 TYPICAL LACROSSE β DECAY

[redacted]

[redacted]

LACROSSE

Project 4.1 - FLASH BLINDNESS - Col. R. S. Fixott

OBJECTIVES

a. To gain information regarding the behavior of lid reflexes under the high illuminations produced by atomic devices; to further evaluate the blink reflexes as a protective mechanism against chorioretinal burns.

b. To gain information on shutter and filter mechanisms for eye protection against chorioretinal burns caused by atomic weapons of various types and yields.

INSTRUMENTATION

The experimental arrangement for this project required the exposure of animal eyes to the weapon detonation at distances which produced retinal lesions in a similar test series during UPSHOT-KNOTHOLE. Rabbits and monkeys were the animals of choice; the former because of ready availability and limited motility of the eye, the latter because of close resemblance to the human eye. Exposure racks were constructed to render nearly complete protection of the animal from whole body effects, when such protection was indicated. Direct exposure was limited to one eye of subject rabbits. The monkeys had both eyes exposed, being used solely for determining the protection offered by the blink reflex.

Staggered shutters of two types were used. The simple closure shutters were open at time zero and closed at varying intervals after, up to 1 second. The closed-open-closed shutters were closed at time zero, opened at a specified time, remained open for varying durations, then closed.

[redacted]

Prototypes of electromagnetic shutters of two types are being field tested as a part of this program. These shutters are designed to prevent or minimize temporary flash blindness, after-images, or retinal burns. Results obtained on animals exposed behind these shutters will be compared with those obtained by other shutters and filter mechanisms.

None of the animals exposed had eyes held open by artificial means. This introduced the possibility that the eye might be closed at time zero. An alarm bell was set up to waken animals. Cameras focused on the animals were used to determine shutter speed and to ascertain whether eyes were open during the time of exposure.

RESULTS

No animals exposed to detonation LACROSSE received chorioretinal burns.

CONCLUSIONS

Predicted total thermal yield at the exposure site on DAVID (Japtan), 8.9 miles from ground zero, should have produced eye damage. Lack of chorioretinal burn injury may be explained by two factors:

a. Greater than expected attenuation of the thermal yield at the exposure site due to high water content of the air and salt water spray at the low exposure site level.

b. The obscuring of a significant portion of the fireball by debris raised by this surface burst.

Since no burns were produced on any of the exposed animals, no estimate of the effectiveness of the various protective mechanisms can be given. However, modification of projected future participation at Eniwetok based on these negative findings is planned. The lack of

[redacted]

eye injury at this distance with this type weapon should then become significant as basic data.

APPENDIX TO REPORT

Following detonation of LACROSSE, the ophthalmologist then with this project (Capt. D.V.L. Brown) was asked to examine seven (7) persons thought to have observed the flash from the airstrip on FRED (Eniwetok) without eye protection. Their story indicates that the actual burst was at least partially obscured by a parked SA-16 type aircraft about 30 yards distant from them. All seven (7) complained of photophobia and headaches associated with seeing the sudden, brilliant light flash. None of them noted significant reduction in visual acuity. Dr. Brown noted questionable retinal edema on five (5) of the seven (7) but no definite retinal burn. These men, with one exception, were rechecked by Col. R. S. Fixott on 27 May 1956. Three still noted headache and some photophobia, but visual acuity was not subjectively or objectively reduced. There was no evidence of eye injury attributable to the atomic weapon.

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LACROSSE

Project 5.3 - In-Flight Participation of a B-66B Aircraft - R.W. Bachman

OBJECTIVE

The primary objective of this test was to measure the gust effects of a low yield nuclear weapon on a B-66B aircraft in flight.

INSTRUMENTATION

Instrumentation for the B-66 consist of the following: 57 strain gages at 4 stations and 26 T.C. at 6 stations on L.H. wing, 16 strain gages at 1 station on the R.H. wing, 22 strain gages at 3 stations and 18 T.C. at 4 stations on the .H. horizontal stabilizer, 17 strain gages at 2 stations and 2 T.C. at 1 station R.H. horizontal stabilizer, 15 T.C. at 3 stations on the L.H. elevator and 2 T.C. at 1 station on R.H. elevator, 26 channels of engine information, 16 calorimeters and 2 radiometers on tail and 1 calorimeter and 2 radiometers in fuselage belly, 3 pressure pickups on the wing 3 on empennage and at 7 stations on fuselage, 16 accelerometers, 8 correlation channels, a photo recorder covering 32 basic flight and engine performance instruments together with 8 indicator lights, 3 motion picture cameras recording wing and tail deflections.

AIRCRAFT POSITION IN SPACE

The ship's aircraft electrical system failed giving the crew none of its normal flight instruments just prior to the run into the target at H-hr. The crew found that they could not maintain a good position and altitude on emergency instruments alone and made an early abort placing them considerably beyond a test condition.

RESULTS

As a result of the abort, the aircraft received no data.

[redacted]

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LACROSSE

Project 5.4 - In-Flight Participation of a B-57B Aircraft - 1st Lt. H.M. Wells

OBJECTIVE

The objective of this test was to measure the effects of a nuclear detonation on an in-flight B-57B aircraft weapon system.

INSTRUMENTATION

Out of 220 channels being recorded, 20 data channels were lost for various reasons. They have been repaired, or replaced by spares.

AIRCRAFT POSITION IN SPACE

The JB-57B was flying at an absolute altitude of 14,500 feet, heading 135° in a tail-on position at H-hr. Slant range to ground zero at H-hr was 15,021 feet (aircraft traveling at 863 ft/sec). Aircraft position at time of shock arrival (H/26.2 seconds) was 28,570 feet slant range at same heading and altitude as at H-hr.

RESULTS

Thermal: Total thermal energy measured was 1.14 cal/cm^2.

Gust: Total gust load at time of shock arrival was 1.094 g's (35% of allowable limit).

Overpressure: Peak overpressure measured was .32 psi at H/26.28 sec.

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LACROSSE

Project 5.5 - IN-FLIGHT PARTICIPATION OF F-84F AIRCRAFT - Captain R. F. Mitchell

OBJECTIVE

The objective of this project was to determine the response of the F-84F weapon system when exposed during flight to the effects of a nuclear detonation.

INSTRUMENTATION

Instrumentation of the F-84F aircraft on LACROSSE was as follows:

1. Waiter (Capabilities F-84F) - Instrumentation of primary concern consisted of 35 strain gages for recording gust response located at three right wing stations, one left wing station, two fuselage stations, two right stabilator stations, and one left stabilator station. Correlative instrumentation consisted of overpressure gages at fuselage Station 75, in addition to time zero fiducial signal, radiometer, and calorimeters located at Station 80, bottom side of the fuselage.

2. Barley (Sideloads F-84F) - The instrumentation consisted of strain gage bridges located at Station 90 and 150 on left and right wing; Station 365 on the fuselage; Flight Station 12 and 35.5 on the left and right stabilizer and Waterline Stations 20 and 53 on the fin. The aforementioned strain gage bridges yielded bending moment information. Structural responses were related to energy inputs with overpressure transducers located on a nose boom and in the sides of the fuselage. A total of 100 channels of information were capable of being recorded.

AIRCRAFT POSITION IN SPACE

1. Waiter - The planned position of Waiter was on an in-bound heading of 050°T with no horizontal offset, to be 8,800 feet from ground zero at T_o and over ground zero at $H + 8$ seconds. The speed on the final run was to be 800 ft/sec.

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This was calculated to give gust response of approximately 80-85 percent design limit on the wings. Actual position on shot day was $\frac{1}{4}$ second early and 100 feet to left of course at T_o; $\frac{1}{4}$ second early and 550 feet left of course at shock arrival. Altitude was 15,190 feet.

2. Barley - The planned position of Barley was on an in-bound heading of 050°T with a horizontal offset of 22,300 feet left of ground zero, to be 15,100 feet abreast of ground zero at H + 19 seconds. Actual position on shot day was 3.25 seconds early and 640 feet left of course at T_o; 1.15 seconds early and 430 feet to left of course at shock arrival, altitude was 10,180 feet.

RESULTS

1. There was no apparent aircraft or instrumentation damage to either aircraft.

2. Data obtained:

a. Waiter received an overpressure of 0.8 psi, whereas 1.0 psi was predicted for the positioning yield. The critical wing bending moment was near 50 percent of design limit. A refined value will be available when the exact distribution of wing fuel is determined. Since aluminum skin temperature rises were not of primary importance in this shot, it was not reduced as priority data in the field.

b. Barley was deprived of obtaining 50 percent of its data due to the recording speed of one of its two 50-channel oscillographs being set at one inch per second. This miss-setting caused the traces to be jumbled up to the extent that data reduction was virtually impossible. Steps have been taken to prevent miss-settings such as this in the future.

[redacted]

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LACROSSE

Project 5.6 - IN-FLIGHT PARTICIPATION OF AN F-101A AIRCRAFT - Captain M. H. Lewin

OBJECTIVE

The objective of Project 5.6 is to determine the responses of an in-flight F-101A aircraft to the thermal, blast, and gust effects of a nuclear detonation. A correlation of the responses, combined with known characteristics of any weapon, will be used to define the maximum safe delivery capability of the aircraft.

INSTRUMENTATION

The aircraft was instrumented with radiometers, calorimeters and pressure transducers to measure the thermal and blast inputs and with strain gages, thermocouples and various other instruments to measure the aircraft responses to the inputs. For LACROSSE shot, the aircraft was positioned to theoretically receive 80% design limit distributed up load on the stabilator based on the positioning yield.

AIRCRAFT POSITION IN SPACE

The aircraft was to fly at 12,000 feet absolute altitude on an in-bound heading of 135°T at a speed of 800 fps TAS. It was planned that the aircraft would arrive over ground zero at T_0 with shock arrival occurring 11 seconds later at a horizontal range of 8,800 feet. Actual shot day position was 140 feet abeam of ground zero at T_0 with shock arriving 12.45 seconds later at a horizontal range of 10,500 feet.

RESULTS

1. Damage: There was no evident damage to the aircraft.

2. Instrumentation: No evident damage to the instrumentation was noted. Of the 50 oscillograph recorded parameters, 48 produced usable data. A standby

[redacted]

shear gage was drifting, producing unreliable readings and an accelerometer went off the paper and was unreadable, although functioning properly. One wing deflection camera jammed and produced no results. The photo panel camera, recording 26 parameters, vibrated excessively at shock arrival and five frames (.312 seconds) were unreadable. It is felt that no data was lost however, since the instrument was not sensitive enough to react in .312 seconds.

3. Gust Data: Overpressure measured was .75 psi. Gust response was about 40 percent of design limit load on the stabilator. Based on the announced yield, the responses were generally less than would have been expected. This indicates some conservatism in the selected position.

4. Thermal Data: Thermal response was considerably less than expected. A ΔT averaging 50°F on the honeycomb surfaces was recorded; this can be compared to a ΔT of 240°F expected. Based on the measured inputs, the temperature rises received on the critical components were about 15 percent low. This also indicates some conservatism in the selected position.

5. Nuclear Radiation: A reading of .585 REM was taken from the pilot's film badge and can be compared to a .81 REM prediction based on the actual yield and position. Again, some conservatism is indicated.

6. General: The participation was considered highly successful by this project. The responses recorded were of sufficient magnitude to serve as a basis for a re-positioning of the aircraft on further shots.

DISCUSSION

The contents of this postshot report are preliminary, tentative and approximate. They are subject to change pending further evaluation of the data collected. They were reported at this time to provide early test results to those concerned with effects of nuclear weapons.

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LACROSSE

Project 5.7 - Thermal Flux and Albedo Measurements from Aircraft -

Capt. R. L. Dresser

OBJECTIVE

The objective of this shot was to obtain thermal flux and albedo information of a nuclear detonation with airborne calorimeter, radiometers, and sixteen mm. motion picture cameras.

INSTRUMENTATION

Instrumentation within the purview of Project 5.7 which was installed in the B-57 included nineteen (19) NRDL calorimeters and two (2) NRDL radiometers for measuring the direct and surface reflected thermal radiation. These instruments possessed various fields of view and were suitably filtered to obtain qualitative spectral distribution information. Six (6) GSAP N-9 cameras were utilized to obtain photographic coverage of the fireball, the earth's surface, and of clouds beneath the aircraft. Two (2) of the cameras oriented towards ground zero were equipped with spectroscopic attachments to obtain continuous spectra in the visible region. Of the other two (2) tail position cameras, one camera had a blue filter and the other had a red filter for the purpose of obtaining pictures at both extremes of the visible region of the spectrum. The remaining two (2) cameras were oriented vertically for the purpose of obtaining photographic coverage of the earth's surface and of clouds beneath the aircraft.

Instrumentation installed in the B-66 consisted of the basic twenty-one (21) thermal instruments, and twelve (12) cameras.

[redacted]

AIRCRAFT-POSITION IN SPACE

Information of the position in space of each aircraft is contained in the reports of the following projects:

Project 5.3 - B-66

Project 5.4 - B-57

RESULTS

Thermal: The very preliminary values of total thermal input to the aircraft obtained on Project 5.7 instrumentation are included in the postshot reports of the appropriate project indicated above.

Photographic Data: Of the eighteen (18) cameras under the purview of Project 5.7, twelve (12) obtained no results because of the abort of the B-66. These films were destroyed. Of the six (6) cameras in the B-57, the red filtered tail camera suffered film breakage and obtained no pictures. This film was destroyed. Apparently reasonably good results were obtained with the remaining five (5) cameras. The two (2) cameras equipped with the spectroscopic attachment, which were located in the EG&G "ELMER" photo tower, also apparently obtained good results.

Film Summary:

Number of magazines loaded	Number of magazines run	Number of magazines for analysis	Number of magazines destroyed
20	20	7	13

58

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[redacted]

Project 6.1 - ACCURATE LOCATION OF ELECTROMAGNETIC PULSE SOURCE - Dr. E. A. Lewis

OBJECTIVE

To utilize the electromagnetic signal originating from nuclear weapon detonations to determine ground zero of detonation. Secondarily to obtain the yield data that is available in the bomb pulse.

PROCEDURE

Location of Ground Zero is made by use of an inverse Loran principle. The exact time the bomb pulse is received at various stations is recorded. The exact time difference in receipt of the electromagnetic pulse between two stations will be used to determine a hyperbolic curve which runs through ground zero. The point of intersection of two or more curves determines ground zero.

There are two systems. One of the systems is known as the long base line system and the other, the short base line system. Each system has two sets of stations. The long base line has one set of stations located in the Hawaiian Islands (Midway, Palmyra and Maui) with synchronizing antenna station at Haiku, Maui, and the other set of stations in the States (Harlingen, Texas; Blytheville, Arkansas; Kinross, Michigan and Rome, New York) with synchronizing antenna station at Cape Fear, North Carolina. The short base lines have one set of stations located in the Hawaiian area (Kona, Hawaii; Papa, Hawaii; and Red Hill, Maui) the other set in California (Pittsburg, Woodland, and Maryville).

RESULTS

1. Short base line in Hawaii recorded bomb pulse.
2. Short base line in California recorded bomb pulse.
3. Long base line in Hawaii recorded bomb pulse.

[redacted]

4. Long base line in States reported equipment failure.

5. Griffiss AFB experienced time synchronization difficulty.

CONCLUSIONS

No conclusion can be made until further information is received from data reduction and interpretation.

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[redacted]

LACROSSE

Project 6.3 - EFFECTS OF ATOMIC EXPLOSIONS ON THE IONOSPHERE - Major Mathew Hawn

OBJECTIVE

The objective of Project 6.3 is to obtain data on the effects of high yield nuclear explosions on the Ionosphere. Principally, to investigate the area of absorption, probably due to the high altitude radioactive particles, and to study the effect of orientation relative to the earth's magnetic field on F2 layer effects.

INSTRUMENTATION

The system comprises:

1. Two Ionosphere recorders, type C-2, operating on pulse transmission, installed in 6 ton trailer vans, one located at Rongerik Atoll and one located at Kusaie in the Caroline Islands.

2. One Ionosphere recorder, type C-3, operating on pulse transmission, installed in a C-97 plane based at Eniwetok Island.

Detailed Description:

1. Ionosphere recorder site (Rongerik Atoll)

site (Kusaie)

a. AN/CPQ-7, type C-2 Ionosphere recorder with a power output of 10 KW peak pulse alternately transmitting and receiving automatically over the range of frequencies from 1 to 25 megacycles. This equipment measures and records at vertical incidence the virtual height and critical frequencies of ionized regions of the upper atmosphere.

b. A 600 ohm multiple wire antenna designed and erected, so that the direction of maximum intensity of radiation will be at the desired vertical angle over all of the operating frequency range from 1 to 23 megacycles. The transmitting and receiving antennas and the ground plane were in mutual perpendicular planes with the plane of the transmitting antenna oriented 53 degrees to the East of Magnetic North.

2. Ionosphere recorder site (C-97 airplane)

a. Same as for Rongerik and Kusaie, except that a C-3 Ionosphere recorder was used. This recorder is the same as the C-2, except for a few modifications and improvements.

b. The transmitting antenna in the C-97 was a single wire delta fastened to the lateral extremities of the tail assembly.

OPERATIONAL

Ground stations at Rongerik and Kusaie, using 15 second sweep, operated on normal 24 hour schedule, 5 sweeps per hour until H-15 minutes; thence continuous until H + 1 hour; thence routine operation.

FLIGHT PLAN FOR C-97 AIRBORNE STATION

Plane remained on ground at Eniwetok for LACROSSE.

RESULTS

All stations operated successfully during this test.

An examination of the film records for LACROSSE indicates that normal conditions existed within the Ionosphere during L-day. There were no noticeable effects on the Ionosphere from Test LACROSSE.

[redacted]

LACROSSE

Project 6.4 → Determination of Characteristics of Airborne Flush Mounted Antennas and Phototube for Yield Determination at Extended Ground to Air Ranges - A. J. Waters

OBJECTIVES

1. To determine the effectiveness of flush mounted airborne antennas and phototubes at various ground-to-air ranges in detecting characteristic low frequency electromagnetic radiation and visible radiation, respectively.

2. To determine the temporal and amplitude characteristics of the low frequency electromagnetic radiation at various ground-to-air ranges.

3. To determine the temporal and intensity characteristics of visible radiation at various ground-to-air ranges.

4. To determine the effects of ambient conditions upon the satisfactory measurement of the parameters specified in items 1 and 2 above.

INSTRUMENTATION

2 fiducial antennas	2 scope cameras
1 whip antenna	1 sequency camera
1 synchronizer	1 recorder
2 photoheads	

2 DuMont Scopes (1 a dual beam, 1 a single beam)

TECHNIQUE

Signal is received by antenna fed through an amplifier and then to the scope. The signal is then photographed. Photohead output is led directly to the recorder. The sequence camera photographs the blast directly for use in correlation of previous data. Distance was approximately 13 miles.

RESULTS

No discernable signal could be seen in the photograph.

[redacted]

Project 8.1 - Basic Thermal Radiation Measurements - W.B. Plum

OBJECTIVE

The principle objective of Project 8.1 was to measure the irradiance as a function of time, thermal radiant energy, and the spectral distribution of the thermal radiant energy from a kiloton-range surface burst and compare these data with corresponding data from tower shots.

INSTRUMENTATION

The NRDL radiometer and the NRDL calorimeter with appropriate filters were used to measure the thermal radiation at Station 815.01 (8,121 ft from GZ) on YVONNE and at Station 812.02 (14,392 ft from GZ) on WILMA. The data were recorded on Heiland oscillographic recorders, two of which were placed at each station. Each recorder gave a time history plot for each of the following instruments:

(1) Total energy, quartz filter, 90 degree field of view

(2) Total energy, quartz filter, 90 degree field of view

(3) Spectral, 3-69 filter, 90 degree field of view

(4) Spectral, 2-58 filter, 90 degree field of view

(5) Spectral, RG-8 filter, 90 degree field of view

(6) Spectral, 7-56 filter, 90 degree field of view

(7) Field of view, quartz filter, 11 deg field of view

(8) Field of view, quartz filter, 22 degree field of view

(9) Field of view, quartz filter, 45 degree field of view

(10) Field of view, quartz filter, 90 degree field of view

(11) Field of view, quartz filter, 160 degree field of view

(12) Radiometer, quartz filter, 90 degree field of view

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The instrumentation for the second recorder at each station was identical with the first recorder system with the exception of an O-52 filter on channel 3 and a Germanium filter behind a 7-56 filter on channel 5. The first 11 instruments were calorimeters and the 12th instrument was a radiometer. Aiming point cameras were used to photograph the detonation. All of the instruments gave data and two of the four cameras, one at each station, functioned satisfactorily.

RESULTS

A preliminary analysis of the data in the field indicates that the energy received at the YVONNE station is low relative to the energy received at the WILMA station. This reduction in energy was, no doubt, due to the fact that the soil was loose and could be stirred up by the blast and thermal radiation, thus obscuring the latter portion of the thermal pulse. A more careful examination in the laboratory of the energy delivered as a function of time will be required in order to arrive at a reasonable transmission coefficient for the two paths. The preliminary data, reduced without the aid of precision instruments, are as follows:

STATION	QUANTITY MEASURED	QUANTITY
815.01	Total Energy	1.8 ± 0.3 cal/cm^2
815.01	Maximum Irradiance	4.5 ± 0.7 cal/cm^2
815.01	Time of Max Irradiance	0.19 seconds
812.02	Total Energy	1.2 ± 0.2 cal/cm^2
812.02	Maximum Irradiance	1.9 ± 0.3 cal/cm^2/sec
812.02	Time to Max Irradiance	0.21 seconds

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LACROSSE

Project 8.5 - AIRBORNE HIGH RESOLUTION SPECTRAL ANALYSIS - Dr. Ralph Zirkind

OBJECTIVE

To determine the radiant power of a 30-40 kiloton surface burst as a function of wavelength and the fireball color temperature as seen from an airborne station. These objectives were to be accomplished by determining the atmospheric attenuation by an independent measurement and correcting the power received at the instrument station aboard the aircraft.

INSTRUMENTATION

The spectral distribution of the radiant power is obtained from a medium quartz Hilger spectrometer. The spectrum is sampled in narrow bands by photocells in the visible region and PbS cells in the infrared. The electrical signal is then recorded on an Ampex 814 tape recorder, with a resolution time of 150 μ sec. The transmission measurement is accomplished by beaming a pulsed light signal of known output and spectral distribution from a fixed point on the ground towards the aircraft. The attenuated beam is received by a detector in the aircraft and recorded on a Heiland recorder. The detector consists of two filtered photomultiplier tubes sampling two spectral regions, (1) .3-.55 microns and (2) .6-1.05 microns. In addition, a quartz filtered calorimeter, 22 degrees field of view, is utilized to measure the approximate radiant exposure received at the spectrometer.

RESULTS

The aircraft was located at the intended position (within 600 feet). (Planned position at H-hour was on an inbound heading of 135°T with no horizontal offset to be abreast of ground zero at H-6.5 seconds with a horizontal range of 5,000 feet at T_o).

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The spectrometer operated normally and to date, data has been obtained on 7 of the available 13 channels. It is possible, additional data exist on the remainder.

The calorimeter functioned and satisfactory data was obtained.

The light-source for transmission measurements failed to operate on D-day and consequently, no data have been obtained. Extrapolated data from simulated runs on ERIE event will be used in the final analysis.

DISCUSSION

The extent of noise within the various tape channels has required a detailed filtering process. Consequently, the final data reduction will be accomplished in the laboratory where suitable filters will be employed. This applies to all subsequent events.

As will be noted here and subsequent participations, accurate positioning can be accomplished by radar observations and navigational calculations.

Delay in data reduction has been caused by the fact that Project 8.5 was to utilize the tape play-back unit of Project 8.1 to conserve funds. This meant that no data processing was possible prior to ZUNI plus three days.

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LACROSSE

Project 9.1 - TECHNICAL PHOTOGRAPHY - Lieutenant Colonel Jack G. James

Three RB-50 aircraft participated on this event, CARTER 1, 2, and 3. Aircraft were positioned at 20,000 feet, 70 nautical miles from Ground Zero, in the West, South and East quadrants. Each aircraft carried a camera assembly consisting of a 70mm cloud camera, a 35mm Eclair motion picture camera and a 16mm GSAP camera with a color load. All three cameras were mounted in an A-28 Gyro Mount. This mission was, for all practical purposes, a test run for air crews and equipment. Time of arrival for positioning purposes was excellent. Navigation to determine known positioning every two minutes was better than previously expected. All cameras, with the exception of one Eclair, operated without malfunction. Pre-determined exposure data for the Tri-X film in the 70mm cloud cameras was in error by approximately 1 f Stop opening, but results are still measurable. Edgerton, Germeshausen, and Grier, Inc. anticipates fair analysis from all negatives. At conclusion of the cloud survey mission, CARTER 1 entered the crater area at plus 1 hour and made three controlled mapping runs over the crater. Results from this photography were excellent.

Note: 9.1 photos are non-pictorial. Negatives have been sent to Boston for analysis and are not available for postshot report.

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PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer
Advisory Group

Program 10 - Thermal Radiation and Hydrodynamics	H. Hoerlin
Program 11 - Radiochemistry	G. Cowan
Program 12 - External Neutron Measurement and High Energy Gamma Measurement	R. L. Aamodt
Program 13 - Fission Reaction Measurements	J. S. Malik
Program 15 - Photo-Physics	G. L. Felt
Program 16 - Physics & Electronics & Reaction History	B. E. Watt
Program 18 - Thermal Radiation	H. Hoerlin

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LACROSSE

Project 10.1 - FIREBALL HYDRODYNAMICS - J. Mullaney

H. Hoerlin

The hydrodynamic yield DELETED was determined on the basis of three Eastman films each from photo stations at Parry, at the southern tip of Runit and from Piiaarai.

Three different methods of data reduction were employed, all of which are based on equation 17 of Chapter 5, by Bethe, in LA-1021, which states that the yield is proportional to the mass of the air engulfed, and the square of the shock velocity. The Bethe-Fuchs mass-correction terms were included.

More specifically, the first method, as employed by Joe Mullaney uses equation 17 and the mass-correction term in an integrated form. The proportionality factor was chosen to give agreement with the "older" pre-TEAPOT radiochemical yields. The resulting data are shown in column 2 of Table 10.1-1 (Integral Method).

The second method, as employed by Roy Blumberg, determines the yield from equation 17 on a point by point basis, also with mass-correction. The velocities were derived graphically from the EG&G radius-time data and the f(σ-1) function was obtained from KING shot, taking 540 KT as its yield. For data see column 3 of Table 10.1-1 (Differential Method).

Finally, the Mach-number scaling method was used by Roy Blumberg in a similar fashion as during TEAPOT, however, applying also mass-correction. The basic 1 KT Mach-number relation used is one worked out by D. Seacord and Tod Snyder utilizing IBM problem M and CASTLE data. See data in column 4 of Table 10.1-1 (Mach Scaling).

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TABLE 13.1-1

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Fig. 15.1-2

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Fig. 15.1-3

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Fig. 15.1-4

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ACKNOWLEDGMENT

This field report was prepared by:

Frank Harrington
Gordon Milne
Marion Shuler
Harold Stewart

It is a preliminary report which describes the results of experiments planned and executed by many people from NRL (Stewart, Hanson, Harrington, Dittrey, Fussell, Weedman, Wall, Shuler, Dudley, Carpenter and Westfall), University of Rochester (Milne, Putman, Fyer), LASL (Ogle, Hoerlin, Skumanich, Shaw, Williamson, Deal and McQueen).

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TABLE 18.1-1

WAVELENGTHS OBSERVED ON DATA PATH

102 SPECTROGRAPH (∠10A)

λ	DESCRIPTION	λ	DESCRIPTION
5391	VW	3350	S
5010	VW, Diffuse	3234	M
4757	S	3150	VS - B
4648	M	3105	L
4425	L	3092	VW
4332	W	3034	M
4138	VW?	3003	M
4110	VW?	2988	MB
3932	M	2953	VW
3870	S	2942	VW?
3486	L	2908	LB
3445	VW		

CODE:

S	Strong
M	Medium
L	Light
W	Weak
B	Broad
V	Very

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TABLE 13,1-2

WAVELENGTHS OBSERVED ON MONITOR PATH, AND SOME COMPARISONS

102 λ 10A	U. of R. λ 2A	Description	Ca	Al	Fe (raies ultimes)
	4321	SC	I4318 (20)		
	4310	SC	I4308 (20)		
4308		W	I4308 (20)		
	4303	SC	I4303 (25) I4298 (18)		
	4291		I4289 (20)		
	4284	WC	I4283 (20)		
4246		W	4248 (10) I4240 (10)		
	4227	l	I4226 (50)		
4216		L			
	4215	W			
	4201	W	4207 (10)		
4192		VW			
	4192	W			
	4185	VW			
4164		M			
	4129	SD			
4128		M			
4090		W			
	4079	SC			
4008		M			
4984		VS			
	3968	VS	I3973 (15) II3968 (500)		
	3962	W		I3961 (2000)	
3960		M		I3961 (2000)	

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TABLE 18.1-2 (Contd)

102 ∠ 10A	U. of R. ∠ 2A	Description	Ca	Al	Fe (raies ultimes)
	3945	C	I3949 (15)	I3944 (1000)	
	3937	C			
	3932	VSD	II3933 (600)		
	3902	W		II3900 (200)	
3390		M			
3370		M			
	3859	SD			
	3853	SD			
	3737	S	II3737 (50)		
3730		MB			(3735)
3714		MB			(3719)
	3706	S	II3706 (40)		
3656		VW		II3655 (100)	
3640		VW	I3644 (15)		
	3633				
3616		W	I3624 (15)		
	3612				
	3603				
3596		M			
	3585			II3587 (500)	(3581) (3570)
	3521	W			
3476		VW			(3475)
	3465				(3465)
3238		VW	I3361 (10) I3350 (10)		
3224		VW	I3226 (10)		

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TABLE 13.1-2 (Contd)

102 ∠ 10A	U. of R. ∠ 2A	Description	Ca	Al	Fe (raies ultimes)
3194		L			
	3185				
	3180	D	II3179 (400)		
3172		L			
	3160	D	II3159 (300)		
3104		VW			
3088		VW		I3092 (1000) I3082 (1000)	
3010		VW			(3020)
2996		VW	I3000 (10)		
2900		W			
2838		VW			

CODE:

S	Strong
M	Medium
L	Light
W	Weak
C	Short Duration
D	Long Duration
B	Broad
V	Very
1	Fuzzy, possibly double

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Fig. 18.2-1. Geometry of the hohlraum

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PART IV

TASK UNIT 4

SC PROGRAMS

E. L. Jenkins
CTU-4

Program 30 - Vulnerability — J. H. Scott

Program 31 - Microbarography — R. Heppelwhite

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LACROSSE

Project 31.1 - Microbarograph - W. A. Gustafson

The purpose of this project was to measure winds in ozone layer of the atmosphere. This was accomplished by measuring at several sites the arrival times of the shock wave reflected from the ozone layer. Five sites were operated: Ujelang, Wotho, Rongerik, Bikini, and Eniwetok. At each site two stations were operated about one mile apart. The difference in arrival times gives the angle of incidence of the shock and information from several stations may be combined to give the winds.

On Lacrosse shot good records were obtained from all stations but no wind velocities are yet available.

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